NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 10 May 31, 1960

GENERAL AND MISCELLANEOUS

9252 FPRC-787

Gt. Brit. Royal Air Force. Inst. of Aviation Medicine. THE DAZZLE EFFECT OF AN ATOMIC EXPLOSION AT NIGHT. T. C. D. Whiteside and K. Bazarnik. May 1952. 18p.

Effects of atomic explosions on night vision of pilots are discussed. Aspects such as local stimulation when the flash is in the subject's visual field, the diffuse stimulation when the explosion is behind the subject, and the effects of increasing the aircraft instrument brightness are considered. Data and conclusions are included. (J.R.D.)

9253 NYO-7759

Clark Univ., Worcester, Mass.

RESEARCH IN NUCLEAR AND RADIOCHEMISTRY PROGRESS REPORT FOR YEAR ENDING JANUARY 31, 1959. T. T. Sugihara. 78p. Contract AT(30-1)-1930. OTS.

The ratio of formation cross sections of Sc^{44m} to Sc^{44} in the reaction $K^{41}(\alpha,n)$ was determined in the energy range 5 to 30 Mev. The ratios in the $Mn^{55}(\alpha,n)$ and $Sr^{86}(\alpha,t)$ reactions are discussed. Improvements in Cs and rare earth separations are suggested. In an attempt to produce long-lived Cr^{56}, the reactions $Co^{59}(p,4p)$ and $Cr^{54}(\alpha,2p)$ were studied. Recoil studies of fission fragments in the 50- and 150-Mev proton fission of uranium are under way. The intent is to investigate the reported change in sign of the anisotropy parameter in going from 50 to 150 Mev. In the study of Szilard-Chalmers reactions, reproducible organic retentions in copper porphines were obtained by extensive purification of the target material. Purification methods as well as some preliminary results for solid copper tetraphenylporphine and a solution of it in benzene are given. Evidence for an asymmetric contribution to the mass distribution in 36-Mev proton fission of Bi is presented. Absolute formation cross sections for a number of products in 36- and 58-Mev fission are tabulated and some charge-distribution data are given. (For preceding period see NYO-7756.) (W.D.M.)

9254

AIR FORCE NUCLEAR PROPULSION. Air Univ. Quart. Rev. II, Nos. 3-4, 1-207(1959).

A review of nuclear propulsion programs, including manned aircraft, and nuclear missile, rocket, and auxiliary power programs is given. The principles of nuclear propulsion are discussed relative to power-reactor fundamentals, thrust and power production from nuclear energy, heat transfer and cooling systems, reactor materials, and the shield. The development status of the direct- and indirect-cycle nuclear propulsion programs, the programs developing reactors for ramjets and as auxiliary power sources, and the radiation effects on aircraft systems are reviewed. The radiobiological and human factors of nuclear-powered aircraft are discussed. Ground maintenance and support of nuclear aircraft are discussed. The public hazards of nuclear aircraft are discussed. (C.J.G.)

9255

THE SPRINGFIELDS WORKS AND THE BRITISH NUCLEAR PROGRAM. Energia nucleare (Milan) 7, 77-87(1960) Feb. (In Italian)

The new Springfields plant in which uranium metal is obtained from its salts by means of continuous processes went recently in operation. A description of it is given, based on information recently obtained from Great Britain. (auth)

9256

PHOTOGRAPHS OF THE HIGH-ALTITUDE NUCLEAR EXPLOSION 'TEAK'. W. R. Steiger and S. Matsushita (High Altitude Observatory, Climax, Colo.). J. Geophys. Research 65, 545-50(1960) Feb.

A sequence of four photographs of the August 1, 1958, high-altitude nuclear explosion 'Teak' near Johnston Island in the Pacific is shown. These photographs were taken from Maui, Hawaii, at an altitude of 3050 meters and 1300 km from the explosion. Three main features of these photographs are evident and are discussed: an auroral arc directed southward; an expanding envelope; and an airglow cloud. The auroral arc extending southward from the explosion is interpreted as the glow produced by a stream of β-decay electrons directed along the earth's magnetic field. This arc apparently extended into the southern hemisphere and was observed from Apia, Samoa. The expanding envelope is interpreted as an excitation-recombination phenomenon produced by an expanding shock front. By assuming an average speed of propagation of 1.3 km/sec of the shock front, the times at which the photographs were taken are estimated. The airglow cloud is interpreted as a residue of ionized material having a lifetime estimated at 15 to 30 minutes. Assuming an electron density of 10 times the normal F_2-region value, an effective recombination coefficient of 10 times the normal F_2 value is obtained. The airglow cloud ascended at a rate of approximately 1000 m/sec and expanded horizontally at a rate of approximately 300 m/sec. (auth)

9257

RADIOISOTOPES P^{32}, Be^7, AND S^{35} IN THE ATMOSPHERE. D. Lal, Rama, and P. K. Zutshi (Tata Inst. of Fundamental Research, Bombay). J. Geophys. Research 65, 669-74 (1960) Feb.

Simultaneous determinations were made of the concen-

trations of the radioisotopes P^{32}, Be^{7}, and S^{35} in several rains collected at Bombay during the monsoon period of 1958. The observed annual deposition rates of P^{32} and Be^{7} are found to agree within the expected meteorological fluctuations with those measured in the preceding two years at Bombay and other stations in India. S^{35} deposition, however, has varied significantly outside normal fluctuations. From the observed variations in the annual fallout of these isotopes during 1956–1958 and relative isotope concentrations in individual rains, it was concluded that nuclear weapons have not resulted in any appreciable contributions to the observed Be^{7} and P^{32} activities. However, S^{35} was contributed in appreciable quantities. During 1958, S^{35} concentrations were very large, amounting to as much as 35 per cent of the observed Sr^{89} concentrations in some rains. The relative concentrations of the isotopes Be^{7} and P^{32} in rains vary in a manner that would be expected for their production in the troposphere by cosmic rays, and their removal by wet precipitation with an average removal period of about 40 days. None of the rain samples analyzed so far could have resulted in precipitation occurring from an air mass which descended in the troposphere after an irradiation in the stratosphere for time periods that are long compared with the half lives of the isotopes. (auth)

9258

MAGNOX REACTOR GENERATION COSTS: AN UP-TO-DATE ASSESSMENT. Nuclear Eng. 5, 95(1960) Mar.

A comparison of the power generation costs for typical 150-Mw single-reactor and 500-Mw two-reactor stations in the United Kingdom and in a "high interest area abroad" is presented. From this comparison it can be seen that the U.K. costs are the more favorable. (B.O.G.)

9259

RADIOACTIVITY IN FRESH VEGETABLES. Public Health Repts. (U. S.) 75, 146-8(1960) Feb.

Data are tabulated on the total beta radioactivity and Sr^{90} content of 402 samples of fresh vegetables collected from various parts of the United States during the latter half of 1958 and 139 samples collected during 1959. The amount of radioactivity present was within limits recommended by the National Committee on Radiation Protection and Measurements. (C.H.)

9260

APPLICATIONS OF NUCLEAR PHYSICS. J. W. S. Hearle (Manchester Coll. of Science and Tech., Eng.). p.371-86 of "Physical Methods of Investigating Textiles." R. Meredith and J. W. S. Hearle, eds. New York, Interscience Publishers, Inc., 1959. 411p. $13.00.

The use of radioactive tracers in the textile industry to study structures of fibers, wear in materials, and chemical reactions in materials is discussed. Radiation techniques for monitoring production quality are discussed. (C.J.G.)

9261

VI RASSEGNA INTERNAZIONALE ELETTRONICA E NUCLEARE. ATTI DEL CONGRESSO SCIENTIFICO, GIUGNO 1959. SEZIONE NUCLEARE. VOLUMES I AND II. (6th International Electronic and Nuclear Review. Acts of the Scientific Congress, June 1959. Nuclear Session. Volumes I and II). Rome, Comitato Nazionale Ricerche Nucleari, [1959]. Vol. 1, 582p., Vol. 2, 590p. (In English, French, and Italian)

Papers presented at the June 1959 meeting are given. The papers mostly involve meteorology and reactor siting, reactor safety, and nuclear research installation siting. Separate abstracts have been prepared for 51 papers. (T.R.H.)

9262

THE IDEAL ATOMIC CENTER (HOW TO ORGANIZE AND SUPPORT). Roland Mas (Commissariat à l'Énergie Atomique, [Paris]). p.103-38 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Richerche Nucleari, [1959]. (In French)

A study is made, based mostly on experience, of the desirable features in an atomic center. Site selection, general plan, general services, administrative services, technical services, underground structures and plan, building structure, special apparatus structure, and costs are discussed. (T.R.H.)

9263

FINANCIAL IMPLICATIONS OF POSSIBLE NUCLEAR ACCIDENTS. Clark C. Vogel (U. S. Atomic Energy Commission, Washington, D. C.). p.459-64 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

A brief treatment is given of the cost factors associated with nuclear installations which result directly from the inherent dangers of atomic energy and the theoretical possibility of a serious atomic industrial accident. (T.R.H.)

9264

LIABILITY FOR NUCLEAR HAZARDS: A MINIMUM PROGRAM OF INTERNATIONAL ACTION. Peider Könz (International Atomic Energy Agency, Vienna). p.465-80 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

The legal liability in nuclear hazards is discussed under the headings of Civil Liability and International Responsibility of State. Discussed in the former are: principle of minimum convention, exclusive jurisdictional and legislative competence of installation states, role of national legislation under minimum international scheme, and integrated pattern of action. Under the latter heading is included: responsibility of the state beyond civil compensation, and precedents and analogies. In conclusion it is stated that it is important to devise adequate safety norms and regulations, and that national concepts and rules should be unified. (T.R.H.)

9265

CONDITIONS TO SATISFY FOR NUCLEAR CENTERS ECONOMICALLY COMPETITIVE WITH CONVENTIONAL CENTERS. Arnaldo M. Angelini (Comitato Nazionale per le Ricerche Nucleari, [Rome]). p.487-94 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

Several factors are given which must be considered for competitive nuclear power: cost based on charge factors or length of use; future demand as well as present needs; sources presently available; seasonal, daily, and hourly power demands versus efficient reactor power levels; and use of conventional power with nuclear power. (T.R.H.)

9266

EVENTUAL REGULATION OF THE EUROPEAN NUCLEAR INDUSTRY. Robert Gibrat (INDATOM, Paris). p. 515-20

of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

Some remarks are made concerning the future of atomic energy and its effect on European industry. (T.R.H.)

BIOLOGY AND MEDICINE

General and Miscellaneous

9267 ACRH-12

Argonne Cancer Research Hospital, Chicago.
SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson, ed. Sept. 1959. 82p. Contract AT(11-1)-69. OTS.

Progress is reported in the following studies: carbohydrate metabolism in human erythrocytes; the development of a system of electron therapy employing a linear electron accelerator and an electromagnetic beam deflector; the capacity of progesterone to inhibit the sodium-retaining influence of aldosterone and desoxycorticosterone; use of tritium-labeled cholesterol in measuring the lability of cholesterol in human atherosclerotic plaques; the capacity of a number of steroid hormone metabolites to provoke fever in man; the failure of human placental tissue homogenates to convert progesterone to estrogens; and tracer studies on enzyme requirements for the incorporation of cytidine triphosphate into ribonucleic acid in a mammalian system. (C.H.)

9268 NP-8355

Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 34. Jan. 15, 1960. 136p. Contract AF41(657)-252.

Seventy-eight chemical compounds were tested for protective effects against radiation lethality in mice. Data are tabulated. Progress is reported in studies on the kinetic and synthetic aspects of the acid-catalyzed reactions of aziridines with thiourea and its analogs, the radioprotective effects of serotonin in mice, the effect of single and protracted exposure to various doses of x irradiation on survival time and mortality rate following subsequent intermittent exposure to death of mice, the ability of various drugs and drug combinations to modify the radioinduced changes in enzyme activities of the hematopoietic tissues and small intestine, the mechanism responsible for the radioprotective action and toxicity of dithiocarbamates, the toxicity of rare earth compounds and their influence on radiation lethality, and the effects of β-aminoethylisothiuronium (AET) on the mitotic activity in regenerating rat liver. (For preceding period see NP-8043.) (C.H.)

9269 UCRL-9004

California. Univ., Berkeley. Lawrence Radiation Lab.
THE EFFECT OF EXOGENOUS CALCIUM AND l-THYROXINE ON PARTURITION IN THE RADIOIODINE THYROIDECTOMIZED RAT (thesis). Marshall Ward Parrott. Dec. 28, 1959. 37p. OTS.

The effects of hypothyroidism and hypoparathyroidism and replacement therapy on reproduction have been studied in the rat. Hypothyroidism was produced by surgery or by irradiation with I^{131} or At^{211}. Replacement therapy was attempted with calcium gluconate, desiccated thyroid substance, thyroxine, triiodothyronine, and a mixture of 90% thyroxine and 10% triiodothyronine. Radioisotopes were administered in sufficient quantity to produce highly significant depressions in metabolic rate and thyroidal uptakes of a tracer dose of I^{131}. Enough time was allowed to elapse to permit complete metabolism of residual thyroid hormone before any attempt was made to breed the animals. The number of pregnancies was drastically reduced in the hypothyroid animals. Thyroid supplement brought the number of conceptions to well within the normal limits. No difference in fertility was observed when TH, T_4, or T_3 were used as the thyroid replacement. Still births and prolonged gestation were common in surgically thyroparathyroidectomized animals and in animals whose thyroids had been destroyed with I^{131}. The number of fetal deaths was reduced, and the length of gestation was reduced to the normal 23 days by intragastric administration of veterinary calcium gluconate daily for at least 5 days before term in the I^{131}-irradiated, thyroxine-treated animals. Calcium gluconate (C.P.) was apparently ineffective when given by mouth. Serum calcium levels were depressed to less than 6 mg % during parturition in I^{131}-thyroidectomized, thyroxine-supported animals (46% of the cases tested). It is concluded that the thyroid gland is essential for the maintenance of the reproductive system in order to permit normal conception and pregnancy. However, its exact role, if any, in parturition could not be determined. It must be assumed that destruction of, or damage to the parathyroid glands was a major contributor to the difficulties observed in parturition. (auth)

9270 UCRL-9005

California. Univ., Berkeley. Lawrence Radiation Lab.
ORIGIN OF LIFE ON EARTH AND ELSEWHERE. Melvin Calvin. Dec. 1959. 45p. Contract W-7405-eng-48. OTS.

Speculations concerning the genesis of life on the earth and the possibility of its occurrence elsewhere in the universe are given. (C.H.)

9271 UR-563

Rochester, N. Y. Univ. Atomic Energy Project.
BIBLIOGRAPHY ON THE BIOLOGICAL EFFECTS OF THORIUM. Eliot Hutchinson. Jan. 18, 1960. 48p. Contract W-7405-eng-49. OTS.

Five hundred thirty references are presented on the biological effects of thorium. (C.H.)

9272 JPRS-L-922-N

THE PENETRATION OF Sr, Cs, Ru, Fe THROUGH THE PLACENTAL AND MAMMARY BARRIERS. V. G. Kulikova. Translated from Med. Radiol. 4, No. 5, 23-7 (1959). 10p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15881.

9273

RADIOPROTECTIVE EFFICACY OF SODIUM CYANIDE. P. De, A. Bose, and S. Bose (Chittaranjan National Cancer Research Centre, Calcutta). Acta Radiol. 53, 146-52 (1960) Feb. (In English)

The radioprotective efficacy of 1.5 mg/kg and 3 mg/kg bodyweight doses of sodium cyanide was tested on rat bone marrow cells in vivo, irradiated with 800 r with the mitotic index as the biologic reference. With both doses the maximum protective efficacy was up to 50% in the period from the 6th to the 9th day. (auth)

9274

STUDIES ON THE RADIOSENSITIVITY AND MORPHOLOGY IN VITRO OF NORMAL AND LEUKAEMIC LYMPHOCYTES. Margaret Jago (Royal Free Hospital, London). Acta Unio Intern. contra Cancrum 16, 75-9(1960). (In English)

Results are reported from a comparative study of the

radiosensitivity and morphology of lymphocytes in culture from the blood of normal subjects and from an unselected group of patients with chronic lymphatic leukemia. Though no morphological difference apart from size was observed between the lymphocytes taken from the blood of normal subjects and the blood of patients with chronic lymphatic leukemia, the results of the radiation experiments suggest that the cells do differ intrinsically. It was not possible to say which biochemical, immunological, or other differences were correlated with altered radiosensitivity. (C.H.)

9275

STUDY OF ALPHA RADIOACTIVITY IN THE SOIL AND IN BIOLOGICAL MATERIAL BY SPECTRUM DETERMINATION. R. Dugnani Lonati and F. Tonolini (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 107-10(1960) Feb. (In English)

With an ionization chamber the low activity of some samples which can be of interest in research work in geology, biology, and health physics was studied. Some measurements were made with samples of soil and plants, and the results are given. It is to be noted that in some soil specimens, radium and ionium are present without uranium, while in some plants alpha activity is due particularly to isotopes of Ra and Pb. (auth)

9276

GROWTH OF HeLa CELLS IN HEAVY WATER. B. V. Siegel, R. O. Lund, S. R. Wellings, and W. L. Bostic (Univ. of California School of Medicine, San Francisco). Exptl. Cell Research 19, 187-9(1960) Feb.

Results are reported from a study of the effect of heavy water on the growth of human cells in tissue culture. (C.H.)

9277

NOMOGRAM FOR ESTIMATING TISSUE DOSE FROM INTERNALLY DEPOSITED β-EMITTING RADIOISOTOPES. Henry Lanz and Mary Sue McCall (Veterans Administration Hospital, Dallas). Intern. J. Appl. Radiation and Isotopes 7, 44(1959) Nov.

A nomogram is presented for use in estimating tissue dose from internally deposited β-emitting radioisotopes. A formula is included for converting the dose to roentgens. (C.H.)

9278

THE DISTRIBUTION AND RADIATION DOSIMETRY OF ZINC-65 IN THE RAT. J. C. N. Wakeley (King's Coll., Newcastle upon Tyne, Eng.); Brenda Moffatt (Francis Delafield Hospital, New York); and Ann Crook and J. R. Mallard (Hammersmith Hospital, London). Intern. J. Appl. Radiation and Isotopes 7, 225-32(1960) Jan. (In English)

The concentration of radioactive Zn^{65} in fourteen organs and tissue has been measured for sixty-nine male rats over a period of 42 days. The results from the reproductive organs and pancreas compare favorably with those of other workers. The concentration of Zn^{65} in the prostate was ten times greater than that in any other organ. Calculation of the radiation dose however, indicated that for a dose of 80 rads to the prostate of the rat the rest of the body would receive approximately 50 rads. In man, such conditions seem hardly suitable for radiotherapy. (auth)

9279

THE STUDY OF THE DIGESTIVE ABSORPTION OF WATER IN PATIENTS SUFFERING FROM CIRRHOSIS OF THE THE LIVER, BY USING TWO HYDROGEN TRACERS. M. Lainé-Böszörményi and P. Fallot (Commissariat à l'Énergie Atomique, Paris). Intern. J. Appl. Radiation and Isotopes 7, 233-43(1960) Jan. (In French)

The rate of appearance of ingested water in the peripheral blood of four patients suffering from cirrhosis of the liver with ascites was studied. For this purpose, oral administration of deuterium oxide and intravenous administration of tritiated water were made simultaneously. This double experiment enables the phenomenon of diffusion of the tracer outside the vascular regions to be observed and calculation to be made of the amounts absorbed by the digestive tract and transferred to the peripheral circulation. (auth)

9280

A DUAL ISOTOPE EFFECT IN THE ENZYMATIC OXIDATION OF DEUTEROMETHYL SARCOSINE. Robert H. Abeles, Wilhelm R. Frisell, and Cosmo G. Mackenzie (Univ. of Colorado, Denver). J. Biol. Chem. 235, 853-6 (1960) Mar.

In the mitochondrial metabolism of sarcosine containing 100 atom % D in the N-methyl group

$$D_3C-NH-CH_2-COOH + O \rightarrow$$
$$\text{active-}CD_2O + \text{glycine} \rightarrow \text{serine-}\beta\text{-}CD_2OH$$
$$\downarrow$$
$$CD_2O$$

the initial rate of oxidation is found to be only two thirds that of sarcosine-CH_3, as shown by both oxygen uptake and rate of CD_2O production. The deuterium has no effect on the rate of serine synthesis. The isotope effect can be attributed to a decrease in the binding forces between the D substrate and the enzyme as well as to an increase in the activation energy for the oxidation of the $-CD_3$ group. When the dehydrogenase system is saturated with mixtures of sarcosine-CD_3 and sarcosine-CH_3, the two species must compete for the same enzyme site and the rate of oxidation of the D substrate becomes only one-fourth that of the H sarcosine. The isotope composition of the oxidation products of such mixtures can be predicted from the K_m values, maximal velocities, and concentrations of the protium and deutero sarcosines. The use of mixed isotope substrates for the elucidation of metabolic pathways is discussed in the light of these experiments. (auth)

9281

TREATMENT OF MEATS WITH IONISING RADIATIONS. III. RADIATION PASTEURISATION OF WHOLE EVISCERATED CHICKEN CARCASSES. B. Coleby, M. Ingram, and H. J. Shepherd (Low Temperature Research Station, Cambridge, Eng.). J. Sci. Food Agr. 11, 61-71(1960) Feb.

Whole eviscerated chicken carcasses were irradiated with γ radiation from Co^{60} using varying doses up to 1 Mrad. Changes in quality were assessed by submitting samples to a laboratory panel and to a domestic consumer panel. The effect of radiation in prolonging the period required for microbial spoilage under chilled conditions of storage was studied. When the meat was stored at 1°C, a dose of 0.8 Mrad gave a five-fold extension of the time required for putrefactive spoilage, and the flavor changes after such a dose were usually not noticed in roasted chickens. The quality of the irradiated carcasses tended to deteriorate during storage, however, and this loss of quality was apparent when the chickens were stored for more than about one and a half times the period required for spoilage of untreated carcasses stored at 1°C. The deterioration is not due to oxidative rancidity of the lipids. (auth)

9282

RELATIONSHIP BETWEEN THE RATE OF FALL-OUT AND THE CONCENTRATION OF STRONTIUM-90 IN HUMAN DIET IN THE UNITED KINGDOM. J. D. Burton,

G. M. Milbourn, and R. Scott Russell (Agricultural Research Council Radiobiological Lab., Wantage, Berks, Eng. and Agricultural Research Council Field Station, Compton, Berks, Eng.). Nature 185, 498-500(1960) Feb. 20.

The relationship between the rate of fall-out and the concentration of Sr^{90} in human diet was calculated for the United Kingdom during 1958. Data from a detailed study of the content of Sr^{90} in human diet and results of field experiments on the absorption of Sr^{90} from the soil were employed. The fraction of the Sr^{90} in milk which is attributable to absorption from soil was also calculated. Results are presented in tabular form and are compared with an assessment based on 1957 data. From an analysis of the data it appears that during 1958 the contamination of milk and other agricultural produce did not rise as greatly as the rate of fall-out. This was attributed to the higher rainfall during 1958 which caused a larger fraction of the deposition to be removed from plants in wash off. (C.H.)

9283

EFFECTIVENESS OF DIETARY SUBSTANCES IN REDUCING THE RETENTION OF CHRONICALLY INGESTED RADIOSTRONTIUM: STUDIES WITH TANNIN. R. H. Wasserman and C. L. Comar (New York State Univ., Veterinary Coll., Ithaca). Nature 185, 629-30(1960) Feb. 27.

Data are presented from a study on the influence of dietary tannin on the bone retention of continuously ingested calcium-45 and strontium-85. (C.H.)

9284

ACCUMULATION OF CAESIUM-137 BY PLANTS GROWN IN SIMULATED POND, WET MEADOW AND IRRIGATED FIELD ENVIRONMENTS. R. C. Pendleton and R. L. Uhler (General Electric Co., Richland, Wash.). Nature 185, 707-8(1960) Mar. 5.

The availability of cesium-137 to plants was examined under conditions simulating shallow ponds, wet meadows, and irrigated fields. The uptake ratio was found to be 450 : 30 : 1. Implications are discussed of the findings on plant uptake of and subsequent incorporation into the food chain of cesium-137 from fall-out. (C.H.)

9285

ELECTRON SPIN RESONANCE STUDIES OF MECHANISMS FOR CHEMICAL PROTECTION FROM IONIZING RADIATION. Walter Gordy and Ichiro Miyagawa (Duke Univ., Durham, N. C.). Radiation Research 12, 211-29(1960) Mar.

Small concentrations of the sulfur-containing chemical protectors, such as cysteine, cysteamine, AET, glutathione, and $Na_2S_2O_4$, in solid solution in certain proteins are found to alter completely the form of the electron spin resonance produced by ionizing radiations in the proteins. For example, solutions of only ½ of 1% by weight of cysteine or $Na_2S_2O_4$ in zein (or two molecules of solute per protein molecule) produce resonances when γ-irradiated which are entirely different from that of pure zein when γ-irradiated. It is believed that these sulfur protectors form complexes with the proteins they protect and thus absorb the ionization or damage that would occur in the unprotected protein. The results indicate that an electron hole or electron spin density can migrate through certain segments of polypeptide chains of proteins. (auth)

9286

CLINICO-ROENTGENOLOGICAL INVESTIGATION OF WOMEN 5 AND MORE YEARS FOLLOWING INTENSIVE RADIATION THERAPY CONNECTED WITH CARCINOMA OF THE UTERINE CERVIX. E. P. Ivanitskaya and L. I. Pavlova. Vestnik Rentgenol. i Radiol. 35, 39-42(1960) Jan.-Feb. (In Russian)

A clinico-roentgenological investigation of 37 healthy women who received intensive radiation therapy for carcinoma of the uterine cervix was conducted. The clinical and roentgenological investigations of the blood and urine, recto-vaginal examinations, roentgenography of the pelvic bones, rectoscopy, and the functional and the anatomical conditions of the kidneys, ureters, and urinary bladder were studied. Leukopenia (3700 to 4000) was revealed in 2 women in 8 and 10 years, after the treatment. Teleangiectasia on the anterior rectal wall was revealed in 3 patients. The vaginal cupula was closed in almost all the cases, scarifications in the parametrium, more marked at the site of former cancer infiltrate, were observed in the majority. Only 5 women exhibited some changes in the upper urinary tract as a result of the mentioned scarification. (auth)

9287

REMOTE RESULTS OF SUCCESSFUL TREATMENT IN MYASTHENIA GRAVIS BY X-RAY IRRADIATION OF THE THYMUS AND SURGICAL TREATMENT OF RADIATION ULCER RESULTING FROM IT. M. A. Merkova, N. P. Mordvinova, and E. B. Golland. Vestnik Rentgenol. i Radiol. 35, 45-7(1960) Jan.-Feb. (In Russian)

A case of complete cure of myasthenia gravis by x-irradiation (6400 r) of the thymus is described. Radiation ulcer appeared in the sternal area of the skin 8 years after the x-ray therapy and was cured by excision of the injured skin with subsequent plastic operation. (auth)

9288

EMPLOYMENT OF RADIOACTIVE PHOSPHORUS (P^{32}) FOR THE DIAGNOSIS OF CARCINOMA OF THE VAGINAL PORTION OF THE CERVIX. Ya. Stanichek and V. Drashil. Vestnik Rentgenol. i Radiol. 35, 47-9(1960) Jan.-Feb. (In Russian)

The employment of P^{32} in the diagnosis of carcinoma of the vaginal portion of the cervix is described. For the measurement of the isotope activity over the tumor surface modified electronic computers were used. It was possible to insert these computers directly into the vaginal cavity. The results of the investigations revealed a marked prevalence of P^{32} absorption by the tumor in comparison with that by the normal tissues. (auth)

9289

BIOLOGICAL IMPLICATIONS OF RADIOACTIVE WASTES. Harry A. Kornberg (General Electric Co., Richland, Wash.). p.385-412 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Waste disposal at Hanford is described from a biologist's point of view. The wastes from fuel preparation, reactor operation, and separation processes are described, and the physical and biological distribution of these wastes introduced into the area are discussed. The objectives of a program to control these wastes so as to prevent harm to man directly or indirectly through his environment are set out. The Hanford process is described briefly, and monitoring carried on there is described. It is concluded that no guide for absolute safety has been found, but experience at Hanford indicates and evaluates possible methods. (T.R.H.)

Biochemistry, Nutrition, and Toxicology

9290 NP-8298

Syracuse Univ., N. Y. Biological [and Food] Research Center.

I. LONG TERM RAT FEEDING EXPERIMENT ON SHRIMP, ORANGES AND WHOLE ORANGES. II. EFFECTS OF IRRADIATED FOODS ON ENZYME LEVELS OF INTESTINAL TISSUE. Report No. 5 [for] March 15, 1959 to September 15, 1959. A. W. Phillips. 35p. Contract DA-49-007-MD-783.

Data are presented on the physical condition of rats maintained for 104 weeks on diets containing 35% solids of irradiated shrimp and peeled oranges. Observations are included on the physical condition of rats maintained for three generations on an irradiated diet. Data are included on enzyme levels in tissues from animals on the irradiated diets. (C.H.)

9291

QUANTITATIVE ASPECTS OF NUCLEATION IN CALCIUM PHOSPHATE PRECIPITATION. Herbert Fleisch and William F. Neuman (Univ. of Rochester, N. Y.). J. Am. Chem. Soc. 82, 996-7(1960) Feb. 20.

A different approach to the problem of biologically induced calcification was developed. It is recognized that collagen fibers possess the property of inducing calcium phosphate crystals to form. This resulted from a clarification of the solubility properties of bone mineral. Whether it does this in vivo and how it accomplishes this remains to be answered by further research. (B.O.G.)

9292

RARE-EARTH FATTY LIVER. Fred Snyder, Edgar A. Cress, and Granvill C. Kyker (Oak Ridge Inst. of Nuclear Studies, Tenn.). Nature 185, 480-1(1960) Feb. 13.

An acute fatty infiltration of liver was observed following the intravenous administration of stable rare earths of lower atomic number (lanthanum to samarium) to rats. A study was made of the level of liver lipids during a ten-day recovery period. Data are also included on liver lipids in both male and female rats, mice, hamsters, rabbits, guinea pigs, chickens, and dogs 48 hours after single intravenous injections of cerium. A significant elevation in liver lipids was noted in rats, mice, and hamsters. No fatty livers were seen in any of the other species except in two male rabbits. Data are tabulated. (C.H.)

9293

AUTORADIOGRAPHIC INVESTIGATION OF INCORPORATION OF H^3-THYMIDINE INTO CELLS OF THE RAT AND MOUSE. Brigitte Schultze and Wolfgang Oehlert (Universität, Cologne). Science 131, 737-8(1960) Mar. 11.

The application of H^3-thymidine results in labeling of those nuclei of cells in which deoxyribonucleic acid (DNA) is synthesized during the interval between application and the sacrifice of the animal. Autoradiographic investigation with H^3-thymidine of rats and mice is reported. This method permits a more exact statement of the number of dividing cells than does the microscopic estimate of mitosis. The latter method is practically impossible in tissues with small fusiform cells. Moreover, it is possible to obtain information about the relative time of DNA synthesis in different cells. (auth)

9294

ZINC-65 IN CYCLOTRON WORKERS. M. A. Van Dilla and M. J. Engelke (Los Alamos Scientific Lab., N. Mex.). Science 131, 830-2(1960) Mar. 18.

Small but persistent body burdens of zinc-65 have been found in cyclotron workers. This radionuclide and others are produced by nuclear reactions with the construction materials of the cyclotron. Only zinc-65 has gained entry into the body, but in amounts of less than 1 percent of the maximum permissible amount. (auth)

9295

SCREENING OF FLUORINE-CONTAINING COMPOUNDS FOR ACUTE TOXICITY. Frank A. Smith, William L. Downs, Harold C. Hodge, and Elliott A. Maynard (Univ. of Rochester, N. Y.). Toxicol. Appl. Pharamacol. 2, 54-8 (1960) Jan.

The maximal tolerated dose and the minimal lethal dose in mice are estimated for a series of twenty fluorine-containing organic compounds, four inorganic compounds of fluorine, and three nonfluorine-containing organic compounds. (auth)

Fallout and Radiation Ecology

9296 CEA-tr-A-661

COMPORTEMENT DU STRONTIUM 90 DANS LE SOL ET LA PLANTE. MESURES AGRICOLES EN VUE DE DIMINUER LA CONTAMINATION DES PRODUITS ALIMENTAIRES. (Behavior of Strontium-90 in Soil and Plants. Agricultural Methods for Lowering Contamination of Food Products). F. Scheffer and F. Ludwieg. Translated into French from Atompraxis 4, 416-19(1958). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 4408.

9297

STRONTIUM-90 CONTENT OF THE STRATOSPHERE. A LOW CONCENTRATION OF STRONTIUM-90 IN THE STRATOSPHERE INDICATES A SHORT STRATOSPHERIC RESIDENCE TIME. Herbert W. Feely (Isotopes Inc., Westwood, N. J.). Science 131, 645-9(1960) Mar. 4.

Since August 1957, long-range, high-altitude aircraft have been systematically sampling the radioactive debris in the stratosphere. Results from the radiochemical analysis of a large number of samples and meteorological interpretation of the data are presented. The strontium-90 content of the stratosphere was found to vary markedly with latitude and altitude. The total stratospheric inventory of strontium-90 was calculated by integrating the specific activities over the entire stratosphere. The residence half-time of nuclear debris in the stratosphere was calculated by comparing the measured stratospheric inventory of strontium-90 with estimates of the total quantity injected into the stratosphere since the testing of nuclear weapons began. A calculation was also made of the strontium-90 concentrations in human bones to be expected in the future if the testing of nuclear weapons in the atmosphere is not resumed. Data from the high-altitude sampling program have also shed some light on the rates of mixing of stratospheric air. Findings are summarized briefly. (C.H.)

9298

ZINC-65 AND ZIRCONIUM-95 IN FOOD. Marvin A. Van Dilla (Los Alamos Scientific Lab., N. Mex.). Science 131, 659-60(1960) Mar. 4.

Zinc-65 has been found in small amounts in muscle and liver samples obtained from cattle raised in Nevada, and also in commercial hamburger and beef liver from the southwestern area. Zirconium-95 and niobium-95 were

found in the liver samples but not in the muscle or hamburger. A trace of zinc-65 was detected in milk but none in people. (auth)

9299

INFLUENCE OF K AND Cs ON RELEASE OF Cs 137 FROM THREE SOILS. H. Nishita, E. M. Romney, G. V. Alexander, and K. H. Larson (Univ. of California, Los Angeles). Soil Sci. 89, 167-76(1960) Mar.

Experiments were conducted to study the influence of stable K and Cs amendments on the uptake of Cs^{137} by Ladino clover upon prolonged cropping of contaminated soils. The addition of K to soils containing relatively high levels of K was ineffective in reducing Cs^{137} uptake by plants, but after the soil K was reduced to a low level by cropping, the addition of K to soils reduced Cs^{137} uptake by plants. This implies that K added to a soil may reduce Cs^{137} uptake by plants when the soil is low in K content but not when high in K. The Cs^{137} uptake by plants increased as the K concentration in the soil was reduced by cropping. The addition of small amounts of Cs to the soil markedly increased Cs^{137} uptake by plants and reduced K uptake. The addition of Cs even at a level severely injurious to plants increased Cs^{137} uptake rather than reduced it. The threshold level for producing injury to clover appeared to be around 4.5×10^{-4} me Cs per g soil in Vina loam. The toxic effect of Cs added in injurious amount to the soil was alleviated by the addition of K. K was, thus, antagonistic to Cs. The amount of Cs and K uptake by plants depended on the soil type. Uptake of Cs^{137} by plants was in the order Hanford > Aiken > Vina, and, concurrently, K uptake was in the reverse order. (auth)

9300

FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 3. Washington, D. C., Joint Committee on Atomic Energy, 1959. p.1969-2618. (GPO)

Hearings were held on May 5, 6, 7, and 8, 1959, before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy of the Congress of the United States on the subject of fall-out from nuclear weapons tests. This volume is an appendix to the hearings and contains additional materials pertinent to the discussions. Separate abstracts have been prepared on 24 statements. (C.H.)

9301

A REVIEW OF INFORMATION ON THE GAMMA ENERGY RADIATION RATE FROM FISSION PRODUCTS, AND ITS SIGNIFICANCE FOR STUDIES OF RADIOACTIVE FALLOUT. Harold A. Knapp (U. S. Atomic Energy Commission, Washington, D. C.). p.1969-76 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Methods used in measuring external dose rates caused by the fission products in radioactive fall-out are reviewed. Available information on gamma photon energy rate from fission products and specific assumptions which now seem most suited for fall-out evaluations are summarized. Procedures are described which are used in calculations of the gamma dose rates over contaminated surfaces. (C.H.)

9302

FALLOUT IN THE OCEANS. A. Seymour (Univ. of Washington, Seattle). p.1976-89 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

The widespread use of nuclear energy for peaceful or military purposes necessitates studies to determine the effects of radioactive contamination upon the oceans and the life therein. The effects of local fall-out, or fall-out occurring during the first two days following the detonation of a nuclear device and within a few hundred miles of ground zero, on the abundance of fission products and the radioisotopic composition of plankton, algae, clams, and fish are discussed. Data from studies in the vicinity of the Eniwetok test site are tabulated and discussed. Recommendations are included for a national policy for regulation of the introduction of radioactive materials in the oceans. (C.H.)

9303

RADIOCARBON FROM NUCLEAR TESTS. Wallace S. Broecker and Alan Walton (Lamont Geological Observatory, Palisades, N. Y.). p.1989-99 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

The C^{14} concentration in the tropospheric CO_2 of the Northern Hemisphere has increased by about 5 percent per year between March 1955 and March 1958. In order to account for the distribution of bomb C^{14} between the hemispheres sufficiently rapid horizontal mixing must exist that either the stratosphere or the troposphere or perhaps both are mixed with a mean time of less than 2 years. Only about 10 percent of the bomb C^{14} produced up to March 1958 has entered the oceans. Differences within one hemisphere appear to be related to local dilution with C^{14} deficient CO_2. The total bomb C^{14} added to the dynamic carbon reservoir through March 1958 is between 5×10^{27} atoms and 28×10^{27} atoms. The range results largely from the uncertainty in the amount stored in the stratosphere. When distributed uniformly throughout the dynamic reservoir, the bomb C^{14} produced through March 1958 will leave the atmosphere with a 0.25 to 1.41 percent higher C^{14} concentration than that of the prebomb era. This increment will then decay away with a half-life of 5,600 years. Critical factors still to be determined are the residence time of gas molecules in the stratosphere and the rate of mixing between surface and deep oceans. Data are tabulated. (C.H.)

9304

STATEMENT CONCERNING THE CONCENTRATION OF BOMB PRODUCED C^{14} IN THE HUMAN BODY. Wallace S. Broecker (Lamont Geological Observatory, Palisades, N. Y.). p.1999-2001 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

The fact that most of the carbon-14 produced during nu-

clear tests is immediately oxidized to CO_2 gas greatly simplifies the problem of prediction of the distribution of bomb carbon-14 in nature. Factors affecting exchange rates of CO_2 between the atmosphere and oceans and mixing rates within the oceans are discussed. The fact that carbon-14 follows carbon through its cycle allows the level of bomb carbon-14 in humans to be estimated from a knowledge of the bomb carbon-14 concentration in atmospheric CO_2. Since, with the exception of marine fish, diet consists almost entirely of carbon produced by the photosynthesis of atmospheric CO_2, only the lag time between photosynthesis and incorporation into body tissue must be considered. Direct comparison between the bomb carbon-14 concentration in carbon from human tissue and that in atmospheric CO_2 for a limited number of cases will uniquely establish the magnitude of the lag. If the lag turns out to be 2 years, it will be possible to say that the bomb carbon-14 concentration in human carbon in 1960 will be the same as that measured for the atmosphere in 1958. The results of laboratory investigations carried out to date are summarized. It is concluded that fairly reliable estimates of future levels of existing bomb carbon-14 in humans can be made from data on the carbon-14 concentration in atmospheric CO_2. (C.H.)

9305

BOMB C^{14} IN HUMANS. Wallace S. Broecker, Arthur Schulert, and Edwin A. Olson (Lamont Geological Observatory, Palisades, N. Y.). p.2001-4 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

The concentration of bomb-produced radiocarbon in humans can be expected to lag behind the rising concentration in atmospheric CO_2. Measurements on human materials suggest a lag of about one year for both breath CO_2 and blood, with a higher value for lung tissue. In evaluating the hazard to man of bomb-produced radiocarbon, the relationship between the carbon-14 concentration in the carbon of the human body and that in the carbon of atmospheric CO_2 must be considered. Data published to date on the atmospheric radiocarbon increase resulting from nuclear tests are reviewed. Results are included from measurements of contemporary body radiocarbon. An attempt is made to estimate the lag between photosynthesis and human consumption of carbon-14 incorporated in the average American diet. It is concluded that the interval between the fixation of carbon in average food and the consumption of that food is less than one year. (C.H.)

9306

STATEMENT OF DR. HARRY WEXLER, DIRECTOR OF METEOROLOGICAL RESEARCH, U. S. WEATHER BUREAU, TO THE JOINT COMMITTEE ON ATOMIC ENERGY HEARINGS ON FALLOUT, MAY 5-8, 1959. p.2004-6 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

The available data on radioactivity in the stratosphere obtained by air sampling and measurements are too scattered in time and space and apparently are not of sufficient quality to answer pressing meteorological questions relating to the stratospheric storage, diffusion, and exchange with the lower atmosphere. Air sampling and assay methods are described. The use of high-speed automatic electronic computers and associated data processing equipment for the computation of data collected by radiosondes, rockets, and satellites is discussed. It is emphasized that new data and concepts make it more pressing that mathematical models for stratospheric circulation be set up and solved on electronic computers. A program to study removal processes of atmospheric dust particles is described. Advantages of the atomic test moratorium in employing the fission products in the stratosphere as tracers in meteorological studies are discussed. The possibility is considered of the loss to space of radioactive debris released from nuclear explosions at about 300 miles from the earth's surface. (C.H.)

9307

SUMMARY STATEMENT OF FINDINGS RELATED TO THE TESTING PROGRAM AT NEVADA TEST SITE. Kermit H. Larson and James W. Neel (Univ. of California Medical Center, San Francisco). p.2006-19 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Data are summarized on methods of measuring fall-out from nuclear test devices, radiation levels from local fall-out, particle size distributions in fall-out patterns, solubility of fall-out materials, the deposition of biologically available radioisotopes, the decay of fall-out radioactivity, and the deposition and biological availability of fall-out, and particularly of strontium-89 and strontium-90, in areas adjacent to the Nevada test site. Data are included from a study of soil-plant factors which affect strontium-90 and cesium-137 accumulation in crop plants. (C.H.)

9308

FALLOUT FROM NUCLEAR TESTS AT THE NEVADA TEST SITE. Gordon M. Dunning (U. S. Atomic Energy Commission, Washington, D. C.). p.2021-2113 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

About one megaton of energy from fission has been released at the Nevada Test Site from nuclear test detonations. The total resultant fission product activity, if measured at one hour after formation, would have been about 400 to 600 billion curies. The utmost care was used to minimize the deposition of the activity outside the Test Site. Data on fall-out from nuclear detonations at the Nevada Test Site are summarized. A map presents the highlights of the estimated radiation doses in pictorial form. Data from a survey made during Operation Plumbbob of dose rate readings inside and outside various type structures are included. (C.H.)

9309

SUPPLEMENTARY INFORMATION ON THE HOT SPOT PROBLEM. A. R. Luedecke (U. S. Atomic Energy Commission, Washington, D. C.). p.2117-29 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Sub-

committee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

A summary discussion is presented of the actual measured levels of strontium-90 in the United States, and the data are interpreted in terms of maximum permissible levels. Data are appended on strontium-90 data for certain areas, North Dakota strontium-90 analyses, findings of the Public Health Service Radiation Surveillance Network for the period from May 1957 through June 1959, and fall-out from nuclear tests at the Nevada Test Site. (C.H.)

9310

DIETARY STRONTIUM 90 ESTIMATES. John H. Harley (Health and Safety Lab., New York Operations Office, AEC). p.2130-3 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

An estimate is presented of total dietary strontium-90 in the United States during 1958. The estimate is based on a sampling diet reported in 1955 by the U. S. Department of Agriculture. An estimate of strontium-90 in bone is based on the mean 1958 diet. It is pointed out that the predicted bone levels are at best valid only for bone laid down during the period of intake of this diet. (C.H.)

9311

[THE PROBLEM OF HOT SPOTS IN FALL-OUT]. Walter Selove (Univ. of Pennsylvania, Philadelphia). p.2133-40 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Problems are discussed which are presented by local variations in fall-out in estimating radiation hazards to the population. It is pointed out that for the hot spot regions in the north central part of the United States, diet and bone levels three to four times the U. S. average can be expected. Procedures used in estimating radiation levels from fall-out are discussed. The meaningfulness of the maximum permissible level concept for fall-out is discussed. The possibility of carrying out large nuclear explosions without appreciable fall-out is considered. (C.H.)

9312

STATEMENT TO THE SUBCOMMITTEE ON FALLOUT PROBLEMS OF THE JOINT CONGRESSIONAL COMMITTEE ON ATOMIC ENERGY. Maurice B. Visscher (Univ. of Minnesota, Minneapolis). p.2140-3 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Fallacies in establishing maximum permissible concentration levels for radionuclides, and particularly for strontium-90, are pointed out. Data are included on concentrations of strontium-90 in samples of wheat from the Great Plains region, milk from Minnesota, and bone from residents of North Dakota. Data cover the period 1956 to 1958. (C.H.)

9313

STATEMENT ON STRONTIUM 90 IN MINNESOTA WHEAT MADE BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY DURING THE AUTHORIZATION HEARINGS, FEBRUARY 27, 1959, BY WILLARD F. LIBBY, U. S. AEC. p.2143-6 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Wheat, rice, and other grasses and vegetables apparently pick up more fall-out from the rain falling directly on the leaves than from the roots and the soil. As a consequence, their level depends more on the rate of fall-out than it does on the total accumulated fall-out in the soil. Soil pickup does not lead to the large fluctuations with seasons of the year that are found in these grasses and has lower values than the peaks which direct leaf pickup can attain during a period of intense nuclear weapons testing when the rate of fall-out can be particularly high for a short time. It is pointed out that the high values of strontium-90 observed in Minnesota wheat probably are due largely to surface pickups from particular rains and are not expected to show a steady rise, except for relatively small soil pickups, unless heavy fall-out rates again occur. Data are tabulated on strontium-90 content in Minnesota wheat, as reported January 1959. (C.H.)

9314

STRONTIUM-90 FALLOUT IN MINNESOTA. W. O. Caster (Univ. of Minnesota, Minneapolis). p.2147-52 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Data are tabulated on levels of strontium-90 in samples of wheat collected during 1956, 1957, and 1958 and milk collected during 1958 in Minnesota. The importance of strontium-90 as an indication of long-lived fission product radioactivity is discussed. A comparison is made of three estimates relating skeletal strontium-90 concentration to skeletal dose. Data are tabulated on the strontium-90 concentration in an average U. S. diet as estimated from food sources. Factors affecting variations in skeletal strontium-90 levels are discussed. (C.H.)

9315

SOME ASPECTS OF RADIOACTIVE FALLOUT IN NORTH DAKOTA. E. W. Pfeiffer. p.2153-61 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Data are presented in graphic form on the levels of strontium-90 in fall-out and in milk in different areas of North and South Dakota during parts of 1957 and 1958. Results are discussed. Data are included on the concentration of strontium-90 in human bone samples. The need for continuing and increasing studies of radioactive fall-out is stressed. (C.H.)

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9316

[RADIOACTIVITY IN MILK SAMPLES]. p.2176-87 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Data are tabulated on the radioactivity due to iodine-131, strontium-89, strontium-90, barium-140, and cesium-137 in milk samples collected during July 1959 from 11 sampling stations throughout the country. (C.H.)

9317

QUARTERLY STATEMENT ON FALLOUT BY THE U. S. ATOMIC ENERGY COMMISSION, SEPTEMBER 1959. p.2188-98 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Data are summarized on surface air radioactivity levels, strontium-90 levels in U. S. milk, strontium-90 removal from milk, the production of carbon-14 in nuclear explosions, plutonium-239 activity in animal tissues, and cesium-137 levels in people and milk. The samples were collected in the U. S. during 1959. (C.H.)

9318

AN INVESTIGATION OF THE LATE CLINICAL FINDINGS FOLLOWING THOROTRAST (THORIUM DIOXIDE) ADMINISTRATION. William B. Looney (U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.). p.2297-2341 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

The clinical status of 35 patients who received thorotrast about 15 years previously was reviewed. Relatively few deleterious effects directly attributable to thorotrast were found. Comparisons are included from histological and autoradiographic studies of tissues from patients who died 18 and 49 days after thorotrast administration and from patients who died 10, 18, and 19 years after thorotrast administration. (C.H.)

9319

EXTRACT FROM "PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES" JANUARY 1959. THE EFFECTS OF STRONTIUM-90 ON MICE. Barclay Kamb and Linus Pauling (California Inst. of Tech., Pasadena). p.2347-62 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Results are discussed of experiments on the effects of strontium-90 injected into mice on life expectancy and on incidence of tumors of bone and blood-forming tissues. A statistical analysis of results is presented. Data are included on the present world-wide levels of contamination with strontium-90 from fall-out. (C.H.)

9320

EXTRACTS FROM "THE LATE EFFECTS OF RADIOACTIVE STRONTIUM ON BONE." HISTOGENESIS OF BONE TUMORS PRODUCED IN RATS BY HIGH Sr^{89} DOSAGE. Stanley C. Skoryna and David S. Kahn. p.2363-4 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Results are summarized from a study of the histogenesis of bone tumors produced in rats by high dosages of injected strontium-89. (C.H.)

9321

AN EPIDEMIOLOGICAL STUDY OF CONGENITAL MALFORMATIONS IN NEW YORK STATE: THE ASSOCIATION OF ELEVATED MALFORMATION RATES IN MAN WITH RESIDENCE IN AREAS CONTAINING NATURAL MATERIALS WITH RELATIVELY HIGH CONCENTRATIONS OF RADIOACTIVE ELEMENTS. John T. Gentry (New York State Dept. of Health, Syracuse); Elizabeth Parkhurst (New York State Dept. of Health, Albany); and George V. Bulin, Jr. (Syracuse Univ., N. Y.). p.2365-2400 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Results are reported from an epidemiological study of congenital malformations recorded for children born during 1948 to 1955 in New York State, exclusive of New York City. The malformation data are compared with data on the distribution of materials with relatively high concentrations of radioactive elements. Possible etiological agents in producing congenital malformations in areas with elevated malformation rates are considered. Results indicated a correlation between areas with high malformation rates and geographical locations containing natural materials with relatively high concentrations of radioactive elements. (C.H.)

9322

A STUDY IN GENETIC DAMAGE. James E. McDonald (Univ. of Arizona, Tucson). p.2402-22 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

A brief summary is presented of methods and results in a statistical analysis of mutagenetic effects within population groups subjected to sustained low-intensity radiation fields. Extension of certain parts of the analysis through use of statistical significance tests is discussed. Data are included from an analysis of congenital malformations recorded for children born during 1948 to 1955 in New York State, exclusive of New York City. Data indicate that more malformations occurred in those areas of the state where higher than average radioactivity is present. (C.H.)

9323

RADIOACTIVE HAZARDS FROM CLEAN HYDROGEN BOMB AND FISSION ATOMIC BOMB EXPLOSIONS. O. I. Leipunskii (Leipunsky). p.2423-47 of "Fallout from Nu-

clear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

The hazards to mankind of the long-lived radioactive substances dispersed throughout the world after the explosion of both fission and fusion bombs are examined. The pure hydrogen bomb considered is of the deutero-tritium variety. Radiation doses to gonads and bones and the number of children suffering from hereditary diseases and leukemia are calculated. The active agents considered are carbon-14 and tritium in the case of hydrogen bomb and strontium-90, cesium-137, and carbon-14 in the case of fission bombs. The distribution of radioisotopes in nature and in organisms is taken into account. Cases involving surface hydrogen bomb explosions are also discussed. It is concluded that in its harmful effects judged according to the size of the radiation dose, a pure hydrogen bomb is just as dangerous as an ordinary fission bomb, but its effects will be produced over a longer period. (C.H.)

9324

BIBLIOGRAPHY [ON] RADIOACTIVE FALLOUT. p.2578-2618 of "Fallout from Nuclear Weapons Tests. Hearings Before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. Volume 3." Washington, D. C., Joint Committee on Atomic Energy, 1959.

Five hundred fourteen references are presented covering the dispersal and fall-out of radioactive debris from nuclear explosions. (C.H.)

9325

TECHNIQUES FOR MEASUREMENT OF AIR AND WATER POLLUTION AND MEASUREMENT OF FALLOUT USED AT THE MOL SITE AND ITS ENVIRONS. R. Boulenger (Centre d'Etude de l'Energie Nucléaire, Mol, Belg.). p.177-98 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

The region of the Mol reactor site in Belgium is described preliminary to giving details of the fall-out monitoring arrangement. Three identically equipped control stations are arranged 500 to 1500 meters from BR-1 reactor. Each station has apparatus for monitoring particle activity and GM counters for ambient dose measurement from filters, both of which are described. Fall-out data for 1958 are given. Surface water monitoring facilities are also described and discussed. (T.R.H.)

Radiation Effects on Living Tissues

9326 AD-215474

Yeshiva Univ., New York. Albert Einstein Coll. of Medicine.

RESPONSE OF RADIATED ANIMALS TO ANESTHETICS AND ANALGETICS. [Period covered]: July 1, 1958–June 30, 1959. Howard L. Zauder. Mar. 31, 1959. 6p. Contract DA-49-007-MD-962.

Mice exposed to total-body ionizing radiation were anesthetized with diethyl ether, divinyl ether, and halothane. There was an increase in the mortality in the anesthetized as opposed to the control irradiated animals. This increase in mortality is related to the dose of radiation as well as to the interval between radiation and anesthesia. Inspection of raw data indicates a higher mortality after divinyl ether than after other agents. Pentobarbital, thiopental, and meperidine increase the death rate following ionizing radiation. In the case of the barbiturates sleeping time is greater in the irradiated animals than in the non-irradiated control group. (auth)

9327 AD-226389

Uppsala Univ. Gustaf Werner Inst. for Nuclear Chemistry and Uppsala Univ. Inst. of Anatomy.

RESEARCH ON "LOCALIZED RADIO-LESIONS." PART II. EFFECT OF HIGH ENERGY PROTONS ON THE BRAIN OF THE RABBIT. Technical Report 1, Appendix 4. Bror Rexed, William Mair, Patrick Sourander, Börje Larsson, and Lars Leksell. May 1, 1959. 18p. Contract AF61 (514)-1247.

Experiments were carried out to determine the effect of exposure to a 185-Mev proton beam on the central nervous system of rabbits. A well-defined lesion of the brain was observed after two weeks which was confined to the path of the beam. After three months the lesions were slightly wider than the path of the beam. Histological changes following irradiation are reported for an interval extending from 2 to 56 weeks after exposure. (C.H.)

9328 JPRS-2224

THE EFFECT OF IONIZING RADIATION ON PROGENY FOLLOWING IRRADIATION OF ANIMALS DURING THE LAST DAYS OF PREGNANCY. Ye. Z. Zuikova, M. Ya. Chaykovskaya, and S. L. Petrosyan. Translated from Vestnik Rentgenol. i Radiol. 34, No. 5, 34-41(1959). 13p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 4255.

9329 JPRS-L-805-N

CONCERNING THE PROBLEM OF THE USE OF FIBRIN FILMS IN RADIATION INJURIES OF THE EXTERNAL INTEGUMENT. S. N. Allaverdyan, G. T. Grigoryan, Ye. Kh. Sarkisyan, and S. A. Mazmanyan. Translated from Med. Radiol. 4, No. 2, 63-6(1959). 6p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14190.

9330 JPRS-L-895-N

COMPLEX METHOD OF TREATING RADIATION INJURIES OF THE SKIN. N. S. Kazantseva. Translated from Vestnik Rentgenol. i Radiol. 34, No. 2, 47-51(1959). 8p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 17753.

9331

AN INVESTIGATION OF LENS OPACITY ON PERSONNEL OPERATING A PORTABLE NUCLEAR REACTOR. J. K. Leverett and C. Harold Beasley (Convair, Fort Worth, Tex.). Am. Ind. Hyg. Assoc. J. 21, 84-6(1960) Feb.

Results are reported from investigations of lens opacity in personnel exposed to many types and intensities of radiation while operating a portable polonium-beryllium neutron source, the Ground Test Reactor, and the Aircraft Shield Test Reactor. Yearly examinations were made on employees subject to neutron radiation exposures. None of the people examined had received excessive radiation exposure. Lens opacities were found in 24 of 655 examina-

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tions. Fifteen were of the congenital variety and 9 were developmental. (C.H.)

9332

IRRADIATION OF THE OVARIES FROM THE URINARY EXCRETION OF IODINE 131. F. Comas and M. Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Am. J. Roentgenol., Radium Therapy Nuclear Med. 83, 501-6 (1960) Mar.

The urinary ovarian dose (the amount of radiation absorbed by the ovaries from the I^{131} excreted by the urine and collected in the urinary bladder) has been calculated. To this end use has been made of I^{131} excretion data on 7 patients; these data have been applied to an experimental model. The urinary ovarian dose in our hyperthyroid patients averaged 24 mrad, and 98 and 141 mrad per mc of I^{131} ingested in the 2 hypothyroid patients. These values represent only about 1 and 5 per cent of the total amount of radiation absorbed by the ovaries of women receiving radioactive iodine. (auth)

9333

ORIGINAL SIGNS AND SYMPTOMS IN PATIENTS SURVIVING FIVE YEARS AFTER ATOMIC BOMB EXPOSURE UNDER 1,000 METERS. Jack J. Lewis and Helen A. Patterson (Atomic Bomb Casualty Commission, Hiroshima and U. S. Naval Hospital, San Francisco). Am. J. Surgery 98, 12-19(1959) July.

Atomic bomb victims who were exposed under 1,000 meters and survived over five years were investigated. There were 619 patients who comprised a total sample. Mechanical, blast, burn, and radiation injuries were evaluated as to onset, duration, severity, body area affected, and type of healing. The modal patient experienced severe radiation and mild trauma. Results were compared with similar earlier studies. The possibility that patients exposed within 1,000 m with radiation and/or thermal injuries have been dying at a faster rate than those with mechanical or no injuries is discussed. (auth)

9334

EFFECT OF γ-IRRADIATION ON SOLUTIONS OF HEMOGLOBIN. V. V. Oppel (S. M. Kirov Order of Lenin Military Medical Academy, Leningrad). Biochemistry (U.S.S.R.) (English Translation) 24, 414-23(1959) May-June.

Solutions of crystalline dog and horse hemoglobin were exposed to γ-rays from a Co^{60} source, at dosages of from 174 to 1630×10^3 r. Irradiation caused a small increase in the nonprotein nitrogen content of the protein solutions, including a rise in the nonprotein tyrosine content of this fraction. A number of low molecular weight peptides were detached from the protein molecules. The amino acid sequences of ten of these peptides were determined. None of them showed any specific biological activity. Chromatographic analysis of the hydrolyzates of irradiated proteins did not reveal any new amino acids or their derivatives. The electrophoretic mobility and the rate of peptic digestion of hemoglobin and serum albumin were not affected by the irradiation of these proteins. (auth)

9335

THE EFFECT OF TOTAL BODY IRRADIATION ON THE ESTIMABLE SH-GROUP CONTENT OF VARIOUS SOLUBLE LIVER PROTEIN FRACTIONS. V. M. Rodionov and E. M. Kedrova (Inst. of Biological and Medical Chemistry, Academy of Medical Sciences, Moscow). Biochemistry (U.S.S.R.) (English Translation) 24, 503-7(1959) May-June.

An apparatus for the preparatory electrophoretic separation of proteins has been described. The present work has confirmed published results about the unequal distribution of SH-groups in the various proteins of the soluble fraction of the rat liver. It was also shown that total-body irradiation caused a decrease in the SH-group content of the nonsecretory liver proteins. The SH-groups of the serum albumin of the liver were found to be resistant to total-body irradiation. (auth)

9336

THE CONTENT OF FREE NUCLEOTIDES, NUCLEOSIDES, PURINE AND PYRIMIDINE BASES IN SOME TISSUES OF HEALTHY AND IRRADIATED RABBITS. T. N. Rysina. Biochemistry (U.S.S.R.) (English Translation) 24, 518-24 (1959) May-June.

We have studied the content of nucleic acid fragments in rabbit tissues. In the liver, spleen, appendix, bone marrow, and mucosa of the small intestine we have found adenine, guanine, hypoxanthine, uracil, and the corresponding nucleosides and nucleotides, with the latter predominating in quantitative ratio. In blood, only adenylic acid is present in appreciable concentration. We have irradiated rabbits in doses of 1000 r and this causes changes in the quantitative composition of these substances. In the liver, appendix, spleen, and bone marrow, the uridylic acid content increased and in a number of cases cytidylic acid, not present in the normal case, appeared. In the last two tissues the uridine content decreased. In the mucosa of the small intestine the uridylic acid content fell and the uridine content rose. Among the purine derivatives the greatest change was shown by inosine (it increased in liver and appendix, decreased in spleen), adenosine (rose in liver, fell in spleen and bone marrow), adenylic acid (increased in liver), and hypoxanthine (increased in liver, decreased in spleen). We have presented a possible mechanism for the change in nucleic acid fragments. (auth)

9337

OXIDATIVE PROCESSES IN EARLY RADIATION REACTIONS. I. Belokonskii and G. Rusev (Military Medicine Research Inst., Sofia). Biophysics (U.S.S.R.) (English Translation) 4, 83-8(1959).

X ray doses ranging up to 20,000 r caused a sequence of changes in the oxidative processes, which were enhanced at 500 to 1000 r, but which were depressed at higher doses. The succinic dehydrogenase, cytochrome oxidase, organic peroxides, and rH_2 with the lower doses altered in such a way as to indicate that oxidation occurred in all organs; the various organs behaved differently at the higher doses. The sensitive organs continued to accumulate oxidized products; the resistant ones ceased to do so, because succinic dehydrogenase is reactivated; and the fairly resistant ones behaved as did the resistant ones, within the errors of experiment. Some protective agents (at low doses) acted by preventing these oxidations from occurring during the irradiation. Ionizing radiation thus acted like any other damaging agent; it produced first an excitation, followed by protective inhibition, but the primary excitation had no protective effect, because it is related to lessened dehydrogenase activity and to increased oxygen consumption. (auth)

9338

THE EFFECT OF X-RAYS AND γ-RAYS ON THE UNILATERAL PERMEABILITY OF FROG SKIN. Iu. A. Kriger and O. M. Zorina (Lomonosov State Univ., Moscow). Biophysics (U.S.S.R.) (English Translation) 4, 88-94(1959).

Total irradiation of Rana temporaria with γ rays from radioactive cobalt at a dose of 6000 r or local irradiation of sectors of abdominal skin using x rays at doses up to 2900 r did not alter the unilateral permeability of the skin to neutral red. In the period following irradiation a change

was observed in the degree of permeability, which was transient in nature. The change in the degree of skin permeability following irradiation was not in any way related to a change in sorption level; the latter remained virtually constant for a long period following irradiation. It was not directly dependent on shifts in the active reaction of the solutions bathing either the external or internal surface of the skin. The increased unilateral permeability of radiation-damaged skin likewise could not be explained by an alteration of the potential difference between both sides of the skin. The cause of the increased unilateral permeability of the skin after irradiation evidently was an increase in the secretory activity of the cutaneous glands. (auth)

9339

A STUDY OF THE MECHANISM OF RADIATION "AFTER EFFECT" IN PROTEINS. L. Kh. Eidus and E. E. Ganassi (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 4, 95-104(1959).

The phenomenon of radiation after effect was observed following irradiation of solutions of myosin with ionizing radiations. The magnitude of after effect in the fraction of the protein molecules which retain their activity after irradiation was proportional to the degree of direct inactivation of the enzyme during irradiation. Study of the kinetics of thermal inactivation of irradiated solutions of myosin indicated that the after effect reaction was intramolecular in character. The activation energy of after effect (postradiation thermal inactivation) in irradiated myosin was markedly different from the activation energy of thermal inactivation of unirradiated protein (77 kcal/mole) and was not dependent on dose. Analysis of published data on radiation after effect in trypsin, pepsin, and egg albumin indicates the similarity of the mechanism of radiation after effect in different proteins. Different possible explanations of the mechanism of radiation after effect in proteins have been analyzed on the basis of the experimental results obtained. The experimental results are in agreement with a theory involving induction of special persistent excited states of the protein molecule during irradiation, characterized by a low activation energy of thermal inactivation. A hypothesis is put forward concerning the possible role of macromolecular ordered structure in water in the mechanism of radiation inactivation of enzymes. (auth)

9340

RELATION OF RECOVERY AFTER IRRADIATION TO TEMPERATURE, OXYGEN TENSION AND CONCENTRATION OF CELL SUSPENSION. V. I. Korogodin, B. N. Tarusov, and A. Kh. Tambiev (Lomonosov State Univ., Moscow). Biophysics (U.S.S.R.) (English Translation) 4, 104-7(1959).

It has been found that the effects of temperature, oxygen tension, and concentration of cell suspension can each be expressed by a separate function of irradiation dose when resting yeast cells are used. (auth)

9341

EFFECTS OF RADIATIONS ON THE HEART. Arthur Jones and John Wedgwood (St. Bartholomew's Hospital, London). Brit. J. Radiol. 33, 138-58(1960) Mar.

A clinical and electrocardiographic study of the effects of radiations on the heart is prefaced by a critical review of the clinical and experimental literature. (auth)

9342

THE EFFECT OF RADIATION UPON THE HEART. Mary Catterall (The General Infirmary, Leeds, England). Brit. J. Radiol. 33, 159-64(1960) Mar.

Twenty-six patients were investigated clinically, radiologically, and electrocardiographically, before and after radiation. The position of the heart relative to the beam of radiation was demonstrated radiologically and the dose received by the left ventricle was calculated. When the left ventricle received a dose of between 2,200 and 3,200 r in three weeks, electrocardiographic changes limited to the T wave occurred and indicated organic injury to the myocardium. This injury was temporary and the lesion behaved in an entirely innocent way. Pre-existing cardiac disease of severe degree may possibly be permanently worsened and it may be thought better to subject such patients to radical surgery rather than radiotherapy. From dissections, an intimate relationship between the heart and internal mammary lymphatics was seen in the majority of cases. In these it appeared that radiation, either by the glancing technique or by the use of a direct field over the internal mammary lymphatics would, unavoidably, deliver to the left or right ventricle a significant dose of radiation if the lymphatics were treated adequately. On dissecting some specimens, and radiologically in one patient, a wedge of lung tissue was seen lying between the lymphatics and the heart. In such cases this lung tissue was probably responsible for protecting the heart against receiving sufficient x rays to cause electrocardiographic change. (auth)

9343

STUDIES ON THE BIOLOGIES OF TWO MITE SPECIES, PREDATOR AND PREY, INCLUDING SOME EFFECTS OF GAMMA RADIATION ON SELECTED DEVELOPMENTAL STAGES. Charles J. Rohde (Oak Ridge National Lab., Tenn.). Ecology 40, 572-9(1959) Oct.

The study is concerned with some gross effects of gamma radiation upon 2 members of the Acarina, prey and predator. The life history of Caloglyphus mycophagus, the prey, is described in detail. The average duration of life cycle was slightly more than 6 days with a range from 4 to 9 days. Observations on the life history of Fuscuropoda marginata, the predator, are also presented. These indicate a life cycle ranging from 30 to 40 days. Data on the effects of radiation upon hatchability of eggs and upon viability of eggs from irradiated virgin adults are presented. Fuscuropoda eggs are insensitive to doses producing 50% mortality in Caloglyphus eggs of comparable age. The predator male is rendered permanently sterile by doses that produce temporary sterility in the prey male. (auth)

9344

THE ACTION OF X-RAYS AND CHLORAMBUCIL ON THE CYTOPLASMIC SOLID CONCENTRATION OF LYMPHOCYTES. R. Barer and S. Joseph (Oxford Univ.). Exptl. Cell Research 19, 51-64(1960) Feb.

The actions of single doses of 300 r x radiation and the nitrogen mustard derivative, chlorambucil, on mouse lymphocytes have been studied quantitatively by cell refractometry. This has enabled changes in the cytoplasmic solid concentration to be followed over periods of up to 28 days. The modal cytoplasmic solid concentration of normal mouse lymphocytes is about 14.9 per cent. The daily variation is small. Large lymphocytes from blood and lymphoid tissues give higher values, between 16.2 and 17.1 per cent. The effects of x rays and chlorambucil are remarkably similar. There is a rapid fall in concentration beginning within 10 minutes and reaching a minimum between 2 and 12 hours. Recovery begins at about 24 hours and a peak

value is attained between 4 and 8 days. This peak value exceeds the pre-irradiation level. A slight decline occurs at 12 to 16 days followed by a second supernormal peak at 16 to 18 days and then a gradual return to normal at 24 to 30 days. The reasons for these changes are discussed. It is suggested that the first fall in concentration is the result of primary damage to the cytoplasm which cause swelling. The remaining changes may be related to regenerative processes in the lymphoid system, with the release of new cell populations into the circulation. (auth)

9345

STUDIES ON THE URINARY FIBRINOLYTIC ACCELERATION WITH SMALL DOSE IRRADIATION OF IONIZING RADIATION. Hisao Yamashita, Koji Kobayashi, Shinji Suzuki, and Shozo Hashimoto (Keio Univ., Tokyo). Keio J. Med. 8, 331-6(1959) Dec. (In English)

The measurement of urine plasmin, a proteolytic enzyme, of nurses working in the radium room succeeded in establishing that plasmin is activated even with a slight irradiation of ionizing rays. The activity of plasmin seems to last for a fairly long time. In the case of a slight irradiation no outstanding morphological blood changes are generally noticed. The measurement of plasmin may be a more effective method for clinical detection of slight irradiation effects. Administration of antiplasmin (Ipsilon) before irradiation shows some preventive action on the radiation injury. (auth)

9346

PROTECTION AGAINST ACUTE EFFECTS OF RADIATION BY HYPOXIA. Patricia J. Lindop and J. Rotblat (St. Bartholomew's Hospital, London). Nature 185, 593-4 (1960) Feb. 27.

Preliminary results are reported from an investigation of the survival of mice of various ages exposed to acute whole-body doses of radiation under hypoxic conditions. Data are tabulated on results obtained with mice aged one to three days and four weeks. A striking protective effect was observed following the temporary removal of oxygen. (C.H.)

9347

EARLY INJURY OF CHROMOEXCRETION AFTER TOTAL IRRADIATION OF RATS. Zdeněk Dienstbier and Oskar Andrysek (Charles' Univ., Prague). Nature 185, 630-1 (1960) Feb. 27.

Evidence is presented for early injury to the chromoexcretional function of liver in rats exposed to lethal doses of whole-body irradiation. Rose Bengal labeled with iodine-131 was used as a tracer in the studies on liver function. (C.H.)

9348

THE SHUTTLE-BOX BEHAVIOUR OF ALBINO RATS DURING PROLONGED EXPOSURE TO MODERATE-LEVEL RADIATION. John E. Overall, W. Lynn Brown, and Loren C. Logie (Univ. of Texas, Austin and U. S. Air Force, Austin, Tex.). Nature 185, 665-6(1960) Mar. 5.

Experiments on rats indicate that perceptual mechanisms may take a minor but real role in the behavioral response to low-level radiation. This perceptual response was observed to be stronger in male than in female rats. (C.H.)

9349

RESISTANCE OF ALGAE TO RADIATION. M. B. E. Godward (Queen Mary Coll., London). Nature 185, 706 (1960) Mar. 5.

Data are tabulated on the radiosensitivity of eight algae. The influence of nuclear cytology on radioresistance of some algae is discussed. (C.H.)

9350

THE EFFECTS OF IONIZING RADIATION ON CALCIUM METABOLISM IN BONES. Adolf Zuppinger and Walter Minder (Universität, Bern). Strahlentherapie 111, 244-8 (1960). (In German)

The effect of irradiation on the calcium metabolism in the bones of grownup rats was studied. 2 to 4 days following oral administration there are constant contents of the easy exchangeable calcium component in the bone. Following irradiation with 2000 r (250 kv, 0.25 mm Cu) there is a fast decrease of the calcium contents to 70% of the initial value. Then a gradual decrease to 50% within 6 weeks following the irradiation occurs. Following an irradiation up to 4000 r the calcium uptake reaches a limit at 64%, which is only little below the value following irradiation with 2000 r. In the unirradiated control extremity an indirect reversible effect is found during the first week. Electrons of 30 Mev cause much less bone damage. Even under consideration of equal absorbed energy the relative biological effectiveness is 0.6. (auth)

9351

THE EFFECTS OF NOXIOUS AGENTS ON CARBOHYDRATE METABOLISM. L. F. Nims and J. L. Geisselsoder (Brookhaven National Lab., Upton, N. Y.). Radiation Research 12, 251-7(1960) Mar.

The action of various so-called stress agents on carbohydrate metabolism is quite specific. Even with those stresses that produce marked changes in the carbohydrate levels of various tissues such as fasting, whole-body x irradiation, or hypoxia, the actual changes produced are characteristic of the agent or procedure employed. Although the mechanisms operative in each stress situation are unknown, it is quite clear that one common feature in the normal animal at least is the participation of the pituitary-adrenal system in a manner that is not yet completely understood. It is probable that both the composition of the adrenal cortical secretion and the time course of the blood levels of the various adrenal corticoids are characteristic of the intensity and the nature of the stress situation. (auth)

9352

SOME THEORETICAL CONSIDERATIONS OF CHANGES IN TISSUE ENZYME ACTIVITY AFTER WHOLE-BODY X-IRRADIATION OF ANIMALS. Herbert J. Eichel and Jay S. Roth (Hahnemann Medical Coll., Philadelphia). Radiation Research 12, 258-65(1960) Mar.

To allow proper interpretation of enzyme changes, it is recommended that in vivo studies of the effects of x irradiation on tissue enzymes, particularly in the spleen and thymus, be carried out with the following considerations in mind. The weight and nitrogen changes in the organs should be reported as well as the specific activity of any enzyme studied, based preferably on nitrogen content, for each post-irradiation period examined. This would facilitate the interpretation of the changes in the specific and total activities of the enzyme and permit a comparison of results obtained in different laboratories. In addition, it is recommended that studies be carried out, if possible, using a variety of radiation doses and time intervals after irradiation, and each study should be assessed according to the principles outlined. It should be noted that many of the spleen enzymes which have been studied thus far exhibit moderate increases in specific activity following whole-body irradiation of rats and mice. These increases reflect, for the most part, only an increased concentration or enrichment of the enzymes with respect to nitrogen due to the marked loss of general cell nitrogen which accompanies

splenic involution. We conclude, then, that increases in the specific activities of spleen enzymes may be more the rule than the exception and that many of these increases are only an indirect expression of the effect of whole-body x irradiation on the spleen. (auth)

9353

STUDIES ON THE EFFECTS OF RADIATION ON LIVING CELLS IN TISSUE CULTURE. I. RADIOSENSITIVITY OF VARIOUS IMAGINAL DISCS AND ORGANS IN LARVAE OF DROSOPHILA MELANOGASTER. Masakatsu Horikawa and Tsutomu Sugahara (National Inst. of Genetics, Mishima, Japan). Radiation Research 12, 266-75(1960) Mar.

In order to study the effect of radiation on larvae of Drosophila melanogaster, various imaginal discs and organs of third-instar larvae were cultured in a synthetic medium together with cephalic complexes as a source of the metamorphic hormone. Irradiated discs or organs were used for culture in one series, and irradiated cephalic complexes were used in the other. From the difference in results obtained in the two series, it was concluded that the decrease in % ecdysis was caused by a functional disturbance of the cephalic complex induced by radiation. It was shown that the brain, the wing disc, and the testis were more radiosensitive than the eye disc, the leg disc, the salivary gland, and the fat body. (auth)

9354

STUDIES ON RADIATION-INDUCED MAMMARY GLAND NEOPLASIA IN THE RAT. III. RELATION OF THE NEOPLASTIC RESPONSE TO DOSE OF TOTAL-BODY RADIATION. V. P. Bond, E. P. Cronkite, S. W. Lippincott, and Claire J. Shellabarger (Brookhaven National Lab., Upton, N. Y.). Radiation Research 12, 276-85(1960) Mar.

The dose dependency of the breast neoplasia response was studied in female Sprague-Dawley rats exposed to graded doses of acute total-body radiation at 40 days of age. The incidence of neoplasia scored at 10.5 to 11 months was linear on dose between 25 r and 400 r. The extrapolated curve passed through zero incidence at zero dose. Above 400 r, the incidence either remained constant or decreased. Multiple neoplasms in single animals were observed, and histologically the neoplasms were adenocarcinomas, adenofibromas, fibroadenomas, and fibrosarcomas. The neoplasms depend on intact ovarian function for maximal incidence. The dose-effect results are discussed in terms of their adequacy for interpretation in terms of the mechanism of radiation-induced neoplasia. It was emphasized that the data reported on the relation of dose and neoplasia of the rat breast cannot be extrapolated to other types of neoplasia or to other species. It was pointed out that linearity of response for a given tissue might be masked by dependence of the response on hormones or other factors in addition to radiation. (auth)

9355

MODES OF RADIATION DEATH IN THE CHICK EMBRYO. I. ACUTE SYNDROMES. S. P. Stearner, M. H. Sanderson, E. J. Christian, and S. A. Tyler (Argonne National Lab., Lemont, Ill.). Radiation Research 12, 286-300(1960) Mar.

In the chick embryo irradiated after 6 days of incubation, mortality within 12 days following acute exposures to Co^{60} γ radiation roughly falls into intervals of 0 to 1 day, 2 to 5 days, and 6 to 12 days. These time periods are closely correlated with the appearance of certain grossly visible pathologic conditions observed in decedents. The pooling of blood in the large veins is associated with deaths occurring within 24 hours after irradiation. Localized accumulations of fluid are principally characteristic of deaths between 2 and 5 days, whereas hepatic lesions as well as evidence of hematopoietic failure predominate among deaths between 6 and 12 days. This association between observed pathology and mortality period suggests a method of partitioning the acute effects that are expressed within 12 days after irradiation. Deaths occurring within each of the three non-overlapping periods are assumed to represent the attainment of lethal bounds by independent injury processes, the kinetics of which are reflected in the joint behavior of the experimental variables associated with deaths within that period. (auth)

9356

MODES OF RADIATION DEATH IN THE CHICK EMBRYO. II. A MODEL OF LETHAL MECHANISMS. S. A. Tyler and S. P. Stearner (Argonne National Lab., Lemont, Ill.). Radiation Research 12, 301-16(1960) Mar.

Among 6-day chick embryos, the mortality observed within 12 days after an acutely lethal irradiation with Co^{60} γ rays was partitioned into groups of 0 to 1 day, 2 to 5 days, and 6 to 12 days. A statistical analysis revealed that dose, exposure time, and mortality could be simply related within each postirradiation time period. Statistical results together with the pathology observed in decedents suggested the following characterization as a possible model of the mechanisms that influence significantly the acute radiation syndrome: (1) Radiation effects which initiate an injury that leads to mortality in the first period are reversed at a constant rate. Vascular collapse was observed as the dominant pathology among decedents of this period. (2) Mortalities occurring in the second period reflect lethal injuries that are sustained via either a reversible or an irreversible process or both. Fluid imbalance describes grossly the pathological expressions of sustained lethal injury. (3) Hepatic lesions and hematopoietic failure are typical indicators of radiation damage among decedents of the third period. Radiation effects that produce an insult that is lethal in this period are irreversible. An alternate model that postulates a single precursory mechanism on which the injury process of the first period and the reversible process of the second period depend is summarized. For the embryo and young chick, the reversal processes of the first period are descriptively and pathologically similar. (auth)

9357

INCREASED SKIN TOLERANCE TO HIGH-VOLTAGE X-RADIATION IN PATIENTS GIVEN METHOXSALEN: CLINICAL OBSERVATIONS ON 30 CASES. Cyril M. Levin and Arnold J. Bajek. Radiology 74, 300-1(1960) Feb.

Skin tolerance to high-voltage x-radiation exposure was substantially increased by giving methoxsalen to patients undergoing radiotherapy. Radiation sickness was also less frequent and less intense than in previous similarly treated patients. Induration or thickening of skin and subcutaneous tissues was also less marked. (C.H.)

9358

THE BINDING POWER FOR DYES OF ISOLATED LIVER MITOCHONDRIA AFTER X IRRADIATION IN VITRO AND IN VIVO. Eberhard Scherer and Klaus Voelker (Universität, Marburg/Lahn, Ger.). Strahlentherapie 111, 237-43 (1960). (In German)

By the use of a quantitative photometric method the binding power of isolated liver-mitochondria of the rat for the dyes lithiumcarmine and trypanblue could be exactly determined. Irradiation with x rays of the suspensions of mitochondria and of the animals showed that the decreased binding power for dye following the irradiation may possibly be a criterion of a damage of the structure at the sur-

face of the mitochondria. The changes can be observed already 6 hours after irradiation which supports electron optical observations, indicating that damage of the structure of mitochondria is one of the earliest morphologic demonstrable radiation damages of the warm-blooded animal cell and it may appear prior to the damage of the metabolism. (auth)

9359

THE EFFECT OF IONIZING RADIATION ON GENETIC RECOMBINATION IN ESCHERICHIA COLI. Dwight E. Wilson (Rensselaer Polytechnic Inst., Troy, N. Y.). Radiation Research 12, 230-6(1960) Mar.

High-frequency recombinant cells of Escherichia coli K-12 were irradiated with γ rays from a Co^{60} source and tested for their ability to act as donors of genetic material to F^- receptor bacteria. The number of recombinants decreased with increasing dose of radiation at a rate corresponding to a sensitive target of volume 1.2×10^{-17} cm^3. The frequency of recombinants showing linkage between the threonine and lactose loci also decreased with increasing radiation doses. It is suggested that the ionizing radiation causes chromosome breaks in the donor bacterial cell and that these breaks cause a decrease in the frequency of linked recombinants. (auth)

9360

THE EFFECTS OF WHOLE AND PARTIAL-BODY IRRADIATION DETERMINED USING ALLYL ALCOHOL TESTS ON WHITE RATS. Wilhelm Eger, Hanno Poppe, and Jürgen Steenken (Universität, Göttingen, Ger.). Strahlentherapie 111, 256-65(1960). (In German)

By means of allyl alcohol damage of the liver the effect of an irradiation dose of 400 r on the whole body, the head, the trunk, the liver area, and the end of the trunk was determined at time intervals of $3\frac{1}{2}$, 7, 14, 28, and 56 hours. In conformity with earlier studies characteristic changes of the resistance against allyl alcohol damage following whole body irradiation or partial body irradiation were observed. Particularly at the time intervals of 7 and 14 hours an increase of the resistance was noted. The course of the resistance curve for partial body irradiation particularly following irradiation of the head shows no principal changes as compared with irradiation of other parts of the body resp. the whole body. If the turns of the resistance changes are considered a measure for the radiation effect, it becomes discernible that at the same dose output the radiation effect decreases according to the irradiated body volume. Under consideration of the volume dose, a remarkably greater sensitivity to radiation was observed for head and liver area, which is, in comparison with whole body irradiation, according to our experiments at the head 6.5-fold, at the liver area 4.2-fold, at the end of the trunk 2.9-fold, and at the trunk 1.3-fold. (auth)

9361

RADIATION DOSE TO GONADS IN X-RAY THERAPY. Georg Fuchs and Josef Hofbauer (Franz-Josef-Spitals, Vienna). Strahlentherapie 111, 297-300(1960). (In German)

In consideration of genetical hazards, radiation dose to the gonads by x-ray therapy was determined. The average gonad dose was found to be 0.77 mr/year/head. This low value is partly attributed to the advanced age of therapy patients, individuals without scope of progeny being excluded from the calculation. X-ray therapy of modern standard therefore does not endanger the future of mankind. (auth)

9362

GENETIC EFFECTS. Earl L. Green (Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.). p.57-71 of "Low-Level Irradiation." Washington, D. C., American Association for the Advancement of Science, 1959.

Data and theories regarding the genetic effects of low levels of radiation on human populations are reviewed and discussed. (C.H.)

Radiation Sickness

9363 JPRS-2223

SOME DATA ON ECHINOPSIN ALKALOID TREATMENT OF PATIENTS FOR CHRONIC RADIATION SICKNESS. G. P. Gubina and L. M. Omel'yanenko. Translated from Vestnik Rentgenol. i Radiol. 34, No. 5, 29-33(1959). 12p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 4272.

9364

CHANGES IN THE QUANTITY OF COBALT IN THE BLOOD AND ORGANS OF DOGS IN RADIATION SICKNESS. G. A. Babenko (Stanislav Medical Inst., USSR). Ukrain. Biokhim. Zhur. 32, 93-9(1960). (In Ukrainian)

The quantity of cobalt in the blood and organs of animals with chronic and acute forms of radiation sickness was studied. The cobalt content of the blood was increased in the acute form of radiation sickness. In the chronic form, the changes were of a wavelike nature. In the liver, spleen, lungs, and muscles of animals dying of radiation sickness, the cobalt content was lower, while in the kidneys it was higher than in the corresponding organs of control animals. (auth)

CHEMISTRY

General and Miscellaneous

9365 AECU-4712

Massachusetts Inst. of Tech., Cambridge.

PROGRESS REPORT ON DEVELOPMENT OF RADIOISOTOPE TRACER TECHNIQUES FOR STUDYING DECOMPOSITION OF COMPLEX ORGANIC WASTES. Period covered: February 1, 1959 to January 31, 1960. Ross E. McKinney. 8p. Contract AT(30-1)-2329. OTS.

A study was made of the biodegradability of alkyl benzene sulfonate type detergents by activated sludge using radiotracers and to develop techniques for studying biodegradability of resistant organic compounds. (auth)

9366 CEA-1146

France. Commissariat à l'Énergie Atomique, Paris.

SIXIEME CONGRES SUR LES LABORATOIRES DE HAUTE ACTIVITE, CHICAGO, MARS 1958. (Sixth Congress on High-Activity Laboratories, Chicago, March 1958). R. Bazire, J. Blin, G. Cherel, and Y. Duvaux. Mar. 1958. 97p.

A very high activity laboratory under construction at CEN, Saclay, is described. This laboratory is designed for examination of EL2 and EL3 fuel rods as well as study of fuel materials. (T.R.H.)

9367 CEA-1360

France. Commissariat à l'Énergie Atomique, Paris.

ETUDE DE L'EFFET SZILARD-CHALMERS SUR LE FERROCYANURE DE POTASSIUM. (Study of the Szilard-Chalmers Effect on Potassium Ferrocyanide). R. Henry, C. Aubertin, and J. Valade. 1959. 9p.

Irradiation conditions and a simple chemical treatment

are described for obtaining from potassium ferrocyanide the mixture Fe^{55}, Fe^{59} with a high specific activity. The recoil behavior of the two isotopes is shown to be different: because of its greater energy Fe^{55} will be enriched by extraction of the ejected atoms from the rest of the molecule. An attempt is made to explain the increase in retention as proportional to the decrease in specific activity. (auth)

9368 NP-8405
Olin Mathieson Chemical Corp. Specialty Chemicals Research Energy Div., New Haven.
SYNTHESIS OF NITROGEN-CONTAINING HETEROCYCLIC FLUID SYSTEMS. Quarterly Progress Report No. 3 [for] Period November 15, 1959 to February 14, 1960. E. H. Kober. 27p. Project No. 9(8-7023). Contract AF33(616)-6342.

Synthetic work aiming for low melting or liquid, thermally stable derivatives of melam was continued. Several melam derivatives were synthesized in which phenyl groups of nonaphenyl-melam (I) and 2-diphenylamino-4,6-bis-(pentaphenylmelamino)-s-triazine (II) are replaced with benzyl and/or methylsubstituted phenyl groups. Other variations prepared are melam derivatives in which phenyl groups of compound I are exchanged by methyl as well as benzyl and/or methylsubstituted phenyl groups. None of these compounds is liquid at room temperature, all having melting points in the range of 103 to 148°C. Investigation in the field of condensed triazine systems were mainly directed to the synthesis of melam derivatives bearing methyl- or ethyl-substituted phenyl groups on the amino-nitrogen atoms. Athough low melting compounds have been obtained, there seems to be only little chance to obtain liquid derivatives of melam by this approach. (For preceding period see NP-8079.) (auth)

9369 ORNL-2893
Oak Ridge National Lab., Tenn.
CATALYZED HYDROLYSIS OF PYROPHOSPHATE BY THORIUM OXIDE. C. M. Boyd, H. P. House, and Oscar Menis. Mar. 2, 1960. 13p. Contract W-7405-eng-26. OTS.

Thorium oxide in aqueous slurries catalyzes the hydrolysis of $Na_4P_2O_7$ to the orthophosphate. In the initial stages of the hydrolysis, the rate is proportional to the ThO_2 concentration, but this effect rapidly diminishes with time, probably due to the inhibiting effect of orthophosphate adsorbed on the catalyst. The time required for a definite fraction of complete reaction to occur is relatively independent of the initial concentration of $Na_4P_2O_7$, thus indicating that the hydrolysis is of the first order with respect to pyrophosphate. Over the range of temperature of 25 to 100°C, the rate of hydrolysis increases approximately 3-fold for each 10° increase in temperature. An activation energy of 20 kcal per mole was calculated for this reaction. (auth)

9370 ORO-252
Arkansas. Univ., Fayetteville.
A BIBLIOGRAPHY OF RESEARCH ON KINETIC ISOTOPE EFFECTS. Arthur Fry, Joe C. Wright, John M. Hill, and Marijon M. Bufalini. [1960]. 31p. Contract [AT-(40-1)-277]. OTS.

The bibliography contains 429 references on kinetic isotope effects. The bibliography is classified as follows: general papers and review articles, carbon isotope effects, hydrogen isotope effects, isotope effects involving other elements, and related materials. (W.L.H.)

9371 USNRDL-TR-389
Naval Radiological Defense Lab., San Francisco.
A PIPETTING DEVICE FOR VOLUMES OF 10^{-4} TO 10^{-9} MILLILITERS. N. Farlow, S. Wiel, and J. Polissar. Nov. 18, 1959. 17p.

A pipetting device for the measurement and transfer of small liquid samples in the volume region 10^{-4} to 10^{-9} milliliters is described. The instrument employs a micromanipulator to hold and maneuver a fine glass capillary pipette under a wide field stereoscopic microscope. The capillary is a replaceable unit having a male ball joint at one end which is clamped in a socket joint at the manipulator arm. Air pressure or vacuum communicated to the pipette through the bore of the ball and socket joint by a piping and valve system permits precise control of pressure on the liquid column in the capillary. By balancing capillary attraction with air pressure, a liquid column can easily be brought to rest at any point in the pipette. Scale marks placed on the exterior of the pipette can be accurately related to the liquid volume by a simple calibrating procedure, reliable to about 2% in the 10^{-4} ml region and to about 8% in the 10^{-9} ml zone. (auth)

9372 WADC-TR-57-126(Pt. III)
American Potash and Chemical Corp., Whittier, Calif.
PHOSPHINOBORINE POLYMERS. Period covered: January 6, 1958 through January 5, 1959. Ross I. Wagner, Frederick F. Caserio, Jr., and Levern D. Freeman. May 25, 1959. 118p. Project No. 1428. Contract AF33 (616)-5435.

With this is bound Appendix II: University of Southern California. CHEMISTRY OF INORGANIC POLYMER COMPONENTS. Anton B. Burg, Louis R. Grant, James E. Griffiths, Kamalkant K. Joshi, Gordon L. Juvinall, and Walter Mahler. Mar. 1959. Subcontract No. AF-5435-1.

Success in preparation of linear polymers of molecular weight over 13,000 is reported. Polymers of the types $[(CH_3)_2\ PBH_2]n$, $[CH_3(C_2H_5)PBH_2]n$, and $[(CH_3)_2PBCl_2]n$ were prepared. In addition, three new cyclic phosphinoborine trimer species were synthesized. These, as well as some of the previously known derivatives, were screened for oxidative, hydrolytic and thermal stability, broadening our knowledge of the relationships between the structure and the physical and chemical properties of phosphinoborines. The synthesis of phosphine intermediates by known methods produced four new secondary phosphines and six new organophosphine derivatives. Work directed toward synthesis of borazene polymers has produced one new borazene derivative and demonstrated the principle of polymerization of borazene nuclei as well. (auth)

9373 WADC-TR-59-533
Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
X-RAY POWDER PATTERNS AND INDEX; METAL COMPOUNDS WITH N-BENZOYL-N-PHENYLHYDROXYLAMINE. Frank L. Chan and Ross W. Moshier. Sept. 1959. 30p. Project title: EXPERIMENTAL TECHNIQUES FOR MATERIALS RESEARCH. Task title: ANALYTICAL CHEMISTRY OF SPECIAL ALLOYING METALS. OTS.

Studies on the organic reagent N-benzoyl-N-phenylhydroxylamine have resulted in the preparation of twenty-eight metallic products with this compound. The method of preparation of each compound, its ultimate analysis, formula, melting point, and characteristic color are given. The x-ray-diffraction powder patterns and indexes are tabulated for ready reference and identification. The reagent and fifteen compounds are reported. (auth)

9374 WAPD-BT-16
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
BETTIS TECHNICAL REVIEW. REACTOR CHEMISTRY

AND PLANT MATERIALS. Dec. 1959. 204p. Contract AT-11-1-GEN-14 and appropriate NObs-Contracts. OTS.

Nine review papers are presented on some reactor chemistry and plant activities at the Bettis Plant in connection with reactor projects. Separate abstracts have been prepared for each paper. (W.L.H.)

9375 WAPD-BT-16(p.1-15)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

PILOT-PLANT EVALUATION OF COD (S.4) DECONTAMINATION SOLUTION FOR REMOVAL OF UO_2. J. M. Lojek, A. Zirkes, and W. T. Lindsay, Jr. 15p.

An extensive series of tests, both in loops and in the laboratory, was undertaken to find a satisfactory decontaminating solution that would not be intolerably corrosive on PWR materials. These tests led to the suggestion of COD (S.4) as a decontaminant for use in PWR in the event of major blanket fuel rod failure with release of pieces of UO_2, and the tests described in this report were conducted as a demonstration of the effectiveness of the selected solution under realistic conditions. Results show that COD (S.4) is an effective decontaminant, under realistic conditions, for a stainless steel system contaminated with UO_2 and is suitable for in-pile loop decontamination after major UO_2 or high-uranium alloy fuel failures with release of UO_2 or fuel corrosion products to the loop. (auth)

9376 WAPD-BT-16(p.16-48)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

CHEMICAL CHARACTERISTICS OF COD (S.4) SOLUTION FOR SOLUBILIZING URANIUM DIOXIDE FUEL AND ASSOCIATED FISSION PRODUCT CONTAMINATION. R. Lloyd. 33p.

A concentrated oxidizing decontaminating solution [COD (S.4)] has been under investigation for possible use in removing particulate, irradiated, sintered UO_2 fuel and the associated fission products that would contaminate the PWR primary system in the event of blanket fuel element ruptures. This paper reports on that phase of the study regarding the physical and chemical characteristics which influence the preparation, application, and disposal of the COD (S.4) solution and the cleanup of the system following decontamination. The major conclusion from this test phase was that no significant deterioration in the performance of the reference COD (S.4) solution should result from its holdup time in the loop. (auth)

9377 WAPD-BT-16(p.102-11)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

DECOMPOSITION OF SOLID FERROUS HYDROXIDE IN HIGH-TEMPERATURE WATER. A. S. Kesten and L. S. Lasher. 10p.

This work was undertaken as the first step in a program aimed at determining the types and rates of transformations occurring during conversion of freshly released, ferrous-alloy corrosion products to their final form, particulate magnetite. The nature and rate of this conversion have a direct effect on the rate of primary system contamination by activated core deposits of corrosion products. Results of this phase show that pure solid ferrous hydroxide decomposes rapidly to form metallic iron and magnetite, primarily the latter, the decomposition rate appearing to be first order with respect to ferrous hydroxide and highly temperature-dependent. (auth)

9378 WSL-R-33

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE DETERMINATION OF THE DENSITY OF HIGHLY ACTIVE LIQUIDS. M. F. Sheppard and E. F. Kemp. Feb. 22, 1952. 14p.

Three methods are described for density determination, based on different physical principles. Two have been used as the basis of remote-control assemblies for use with highly active liquids, and one method has been adopted for routine use. (auth)

9379 AEC-tr-3991

THE FORMATION OF FERRITES IN THE AGING OF METAL HYDROXIDES. V. P. Chalii. Translated for Los Alamos Scientific Lab. from Ukrain. Khim. Zhur. 25, 285-7 (1959). 4p. JCL or LC.

The speed of ferrite formation in the aging of metal hydroxides was investigated relative to the effects of: the pH value at which the hydroxides precipitated, the structure of the hydroxides, and the hydroxide stability toward dehydration. The speed of ferrite formation was determined for various agings by x-ray structure phase analysis. (C.J.G.)

9380 CEA-tr-R-732

ETUDE DES POTENTIELS D'OXYDO-RÉDUCTION DU PLUTONIUM DANS L'ACIDE NITRIQUE. (Study of Oxidation-Reduction Potentials of Plutonium in Nitric Acid). P. I. Artyukhin (P. J. Artioukine), A. D. Gelman (Guelman), and V. I. Medvedovskii (Medvedovski). Translated into French from Doklady Akad. Nauk S.S.S.R. 120, 98-100 (1958). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 13859.

9381 CEA-tr-R-783

EFFET ISOTOPIQUE À LA TEMPÉRATURE CRITIQUE. (Isotope Effect at Critical Temperature). I. B. Rabinovich and N. A. Gorbushenkov. Translated into French by B. De Trezvinsky from Doklady Akad. Nauk S.S.S.R. 120, 566-9 (1958). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13773.

9382 NP-tr-363

PROTON MAGNETIC RESONANCE IN TITANIUM AND ZIRCONIUM HYDRIDES. O. T. Malyuchkov and B. N. Finkel'shteĭn. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 127, 822-4(1959). 7p. JCL or LC.

Proton magnetic resonance in titanium and zirconium hydrides was studied at a frequency of 21,449 kc in a magnetic field of 5035 gauss. The measurements were performed on a radio-frequency, permanent-magnet spectrometer. (C.J.G.)

9383

STUDIES ON THE HYDROLYSIS OF METAL IONS. 24. HYDROLYSIS OF THE URANYL ION, UO_2^{2+}, IN PERCHLORATE SELF-MEDIUM. Sirkka Hietanen and Lars Gunnar Sillén (Royal Inst. of Tech., Stockholm). Acta Chem. Scand. 13, 1828-38(1959). (In English)

The hydrolysis of UO_2^{2+} was studied in perchlorate self-medium at 25°C, using quinhydrone or glass electrodes, which gave concordant results. The data indicate the two main reactions: $2UO_2^{2+} + H_2O \rightleftharpoons (UO_2)_2OH^{3+} + H^+$ (equilibrium constant β_{12}) and $2UO_2^{2+} + 2H_2O \rightleftharpoons (UO_2)_2(OH)_2^{2+} + 2H^+$ (equilibrium constant β_{22}). Small deviations at low acidities could be explained assuming the reaction $3UO_2^{2+} + 4H_2O \rightleftharpoons (UO_2)_3(OH)_4^{2+} + 4H^+$ (equilibrium constant β_{43}). The values obtained were: in the medium 0.4 UO_2^{2+}, 1.0 (Na)ClO_4, $\log \beta_{12} = -3.66 \pm 0.20$, $\log \beta_{22} = -6.02 \pm 0.03$. In 1.4 UO_2^{2+}, 3.0 (Na)ClO_4, $\log \beta_{12} = -3.68 \pm 0.20$, $\log \beta_{22} = -6.31 \pm 0.03$, $\log \beta_{43} \approx -12.6$ (quinh.), -12.9? (glass). The

values for β_{22} and β_{43} are of the same order as obtained in an inert medium. The concentration of $(UO_2)_2OH^{3+}$ is appreciable only at high UO_2^{2+} concentration. (auth)

9384

TRITIUM EXCHANGE BETWEEN CELLULOSE AND WATER: ACCESSIBILITY MEASUREMENTS AND EFFECTS OF CYCLIC DRYING. A. R. G. Lang and S. G. Mason (McGill Univ., Montreal, Can.). Can. J. Chem. 38, 373-87(1960) Mar.

Tritium exchange between cellulose and water vapor was used to measure the accessibilities of amylopectin, amylose, regenerated cellulose, wood pulp, bacterial and Valonia cellulose, and cellulose trinitrate using both gas counting and solid counting techniques. The results compare satisfactorily with other accessibility and crystallinity measurements. The incomplete reversibility of the exchange reaction was used to study directly changes in the accessibility of regenerated cellulose which occurred during repeated wetting and drying from water. The results indicated that a partial interchange of accessible and inaccessible regions occurs during wetting and drying. (auth)

9385

EFFECTS OF SMALL AMOUNTS OF Al_2O_3 ON COMPOSITION LIMITS OF THE CUBIC PHASE COMPOSED BY CaO AND ZrO_2. Antonio Cocco (Università, Trieste, Italy). Chim. e ind. (Milan) 42, 142-5(1960) Feb. (In Italian)

Furthering the investigations on the effects of the binding mass quality on the structure of zirconia-based refractories, the effect of small amounts of Al_2O_3 on composition limits of the cubic phase composed by CaO and ZrO_2 is examined. Experimental results allow to trace a diagram, which shows that small amounts of Al_2O_3 do not exert any substantial effect on the limits between which, at high temperature, the cubic structure phase exists in the $CaO-ZrO_2$ system. (auth)

9386

THE EXCHANGE BETWEEN THE S^{35} OF AMMONIUM SULFATE AND THE S^{32} OF INDOXYL SULFATE IN AQUEOUS SOLUTION. George Wellers and Jean Moretti (Faculté de Médecine, Paris). Compt. rend. 250, 1140-2 (1960) Feb. 8. (In French)

Indoxyl sulfate is placed in aqueous solution with $NH_4S^{35}O_4$. After chromatographic separation, some radioactivity of the spot of indoxyl sulfate is observed. This exchange of isotopes in vitro causes the greatest reserve with respect to the interpretation of the results obtained after the administration in vivo of radioactive sulfates. (tr-auth)

9387

ON THE KINETIC ISOTOPE EFFECT IN CRACKING. A. M. Brodskii (Brodsky), R. A. Kalinenko, and K. P. Lavroyskii (Lavrovsky) (Inst. of Petrochemical Synthesis, Academy of Sciences, USSR). Intern J. Appl. Radiation and Isotopes 7, 118-22(1959) Dec.

Investigations on the kinetic isotope effect in cracking of $C^{14}H_3-C^{12}H_3$ and $C^{14}H_3-C^{14}H_3$ are described. The results obtained are consistent with the suggested hypothesis on the effect of symmetry on decomposition rates. (auth)

9388

USE OF THE ISOTOPE EFFECT IN THE STUDY OF HETEROGENEOUS CATALYTIC REACTIONS. Joel R. Gutmann (Israel Atomic Energy Commission, Rehovoth). Intern. J. Appl. Radiation and Isotopes 7, 186-91(1960) Jan. (In English)

The applicability of the isotope effect on heterogeneous reaction rates as a kinetic tool is discussed. The isotope effect on the exchange reaction rate of ammonia and hydrogen on iron catalyst has been measured using deuterium and tritium as labelling isotope. A general rate equation is derived for this exchange reaction, and it is shown that under certain conditions information on the reaction mechanism can be obtained from the measured isotope effect. (auth)

9389

THE SECONDARY HYDROGEN ISOTOPE EFFECT. E. A. Halevi (Israel Inst. of Tech., [Haifa]). Intern. J. Appl. Radiation and Isotopes 7, 192-7(1960) Jan. (In English)

Secondary isotope effects are reviewed with particular regard to their interpretation within a consistent scheme. It appears that adherence to formal considerations of vibrational frequency shifts is inadequate for the interpretation of many experimental results, and that these may be more fruitfully discussed in terms of electronic substituent effects, which differ for isotopic molecules by virtue of their slightly different mean configurations. (auth)

9390

HYDROGEN ISOTOPE EFFECTS IN THE PHOTO- AND RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS. Joshua Jortner and Gabriel Stein (Hebrew Univ., Jerusalem). Intern. J. Appl. Radiation and Isotopes 7, 198-206 (1960) Jan. (In English)

The results obtained by various workers on hydrogen isotope effects in the radiation and photochemistry of aqueous solutions are surveyed. The reactions likely to lead to isotope effects are discussed. (auth)

9391

INVESTIGATION OF URANYL NITRATE AQUEOUS SOLUTIONS BY COMBINED SCATTERING METHOD. S. Mints and Z. Kentskii (Inst. of Physical Chemistry, Academy of Sciences, Poland). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 1182-3(1959) Oct. (In Russian)

Studies were made of solution structures and interactions between ions and molecules. The method of combined scattering was used for determining the structural changes in nitric acid media. The concentration dependence of the UO_2^{2+} 860 cm^{-1} line in aqueous $UO_2(NO_3)_2$ solutions was analyzed and tabulated as well as the relationship of molar intensity to the relative nitrate ion concentration. (R.V.J.)

9392

RADIATION DAMAGE IN ORGANIC CRYSTALS. I. $CH(COOH)_2$ IN MALONIC ACID. H. M. McConnell, C. Heller, T. Cole, and R. W. Fessenden (California Inst. of Tech., Pasadena). J. Am. Chem. Soc. 82, 766-75(1960) Feb. 20.

An analysis of the electron magnetic resonance of single crystals of malonic acid that were subjected to x-ray damage indicates that: (a) the principal long-lived paramagnetic species produced by the x-ray damage is $CH(COOH)_2$. (b) The carbon, oxygen and carboxyl hydrogen atoms of this radical are oriented in the crystalline lattice in the same way as these atoms are arranged in the parent undamaged malonic acid molecule. (c) The z,x,y components of the diagonal (electron-spin)–(nuclear-spin) coupling dyadic for the proton attached to the α-carbon atom are found to be of the same relative sign and of magnitudes 29, 61, and 91 Mc, respectively. In this orthogonal axis system, z is the CH bond direction and x is perpendicular to the plane of the three carbon atoms. These results are in excellent agreement with theoretical values of the distributed dipole and contact hyperfine interactions and show that this molecule is a π-electron radical, that the unpaired electron is concentrated almost entirely on the α-carbon and that the spin density on the in-plane σ-proton is negative. The observed g-factors for this radical are

$g_x = 2.0026$, $g_y = 2.0035$, and $g_z = 2.0033$ and are in good qualitative agreement with previous theoretical estimates of these quantities. (auth)

9393

MECHANISM OF SUBSTITUTION REACTIONS OF COMPLEX IONS. XVI. EXCHANGE REACTIONS OF PLATINUM(II) COMPLEXES IN VARIOUS SOLVENTS. Ralph G. Pearson, Harry B. Gray, and Fred Basolo (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 82, 787-92(1960) Feb. 20.

The rate of chloride exchange of trans-$Py(py)_2Cl_2$ in a variety of solvents depends upon the properties of the solvent in a way consistent with strong interaction of the solvent and metal ion in the rate-determining step. Solvents with empty, or potentially empty, orbitals are particularly effective probably because of π-bonding to the platinum. The term biphilic reagent is proposed for substances which can simultaneously donate and accept electrons in substitution reactions. (auth)

9394

ISOTOPTIC EXCHANGE REACTIONS. VI. HALOGEN EXCHANGE IN THE SYSTEM BCl_3-POCl_3. Rolfe H. Herber (Rutgers Univ., New Brunswick, N. J.). J. Am. Chem. Soc. 82, 792-5(1960) Feb. 20.

The isotopic halogen exchange between $POCl_3$ and BCl_3 was investigated with the use of Cl^{36} labeled reactants. While a rapid (complete within one minute) exchange is noted at 0° when $POCl_3$ is present in excess, as well as in an equimolar mixture of the two components, no halogen exchange is observed in an excess of BCl_3. These data are interpreted on the basis of a structure previously proposed for the addition compound in which the bonding is through the phosphoryl oxygen. A mechanism for the rapid halogen exchange in $POCl_3$ rich systems is suggested, which does not necessitate the formation of a free tetrachloroborate anion as proposed in earlier studies of halogen exchanges in BCl_3. (auth)

9395

ACID IONIZATION CONSTANTS OF ALCOHOLS. II. ACIDITIES OF SOME SUBSTITUTED METHANOLS AND RELATED COMPOUNDS. P. Ballinger and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc. 82, 795-8(1960) Feb. 20.

The acid ionization constants of twelve simple alcohols were determined by a conductivity procedure for dilute solutions in water at 25°. The values of K_{HA} range from 5.8×10^{-13} for trichloroethanol to 3×10^{-16} for methanol and allyl alcohol. For several of the alcohols comparisons can be made of their relative acidities in water with the relative acidities reported by Hine and Hine for the solvent 2-propanol. The qualitative agreement is good. A plot of pK versus σ^* for the aqueous ionization of a set of simple substituted methanols leads to a straight line with slope $\rho^* = 1.4$. The data lead to an extrapolated pK value for ethanol in water of 15.9. Using this, the relative acidities of methanol, water, and ethanol are found to be in the ratio 3:2:1 for the solvent water. Data also are given for ionization of two of the alcohols in deuterium oxide. The resulting K^H/K^D values of 4.5 for 2,2,2-trifluoroethanol and 4.9 for 2-chloroethanol fit in well with data for carboxylic acids and phenols. (auth)

9396

EFFECT OF COMPLEX FORMATION IN THE POLAROGRAPHIC REDUCTION OF ARSENIC(III) IN HYDROCHLORIC ACID. William H. Reinmuth and L. B. Rogers (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 82, 802-5(1960) Feb. 20.

From a knowledge of the species in solution and the effects of changes in the concentrations of chloride and hydrogen ions on the half-wave potential, electron-transfer in $As(OH)Cl_2$ was shown to be the slow step in the reduction of arsenic(III) to (0) in acidic chloride media. Evidence is cited for bridging by chloride. (auth)

9397

IONIC ASSOCIATION IN POLYVALENT SYMMETRICAL ELECTROLYTES. I. CONDUCTANCES OF SEVERAL RARE EARTH HEXACYANOCOBALTATES(III) IN DIOXANE–WATER MIXTURES. Gordon Atkinson (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 82, 818-20(1960) Feb. 20.

The conductances of lanthanum, neodymium, samarium, and yttrium hexacyanocobaltates(III) were measured in dioxane–water mixtures at 25°. All measurements were made in the concentration range below 0.002 molar. Dissociation constants for these 3–3 electrolytes are calculated by the method of Shedlovsky (K is approximately 10^{-4}). Ion-pair size parameters are calculated by Bjerrum's method. Although Walden's rule is obeyed, the Bjerrum "a" parameter varies with the dielectric constant of the solvent mixture for a given salt, indicating lack of adherence to the electrostatic Bjerrum model. Yttrium cobalticyanide gives results somewhat at odds with the other three salts. (auth)

9398

STUDIES INVOLVING ISOTOPICALLY LABELED FORMIC ACID AND ITS DERIVATIVES. V. STUDIES OF THE DECARBONYLATION OF FORMIC, BENZOYLFORMIC AND TRIPHENYLACETIC ACIDS IN SULFURIC ACID. Gus A. Ropp (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 82, 842-52(1960) Feb. 20.

By employing deuterium and carbon-14 isotope fractionation studies, carbon-14 tracer studies, and oxygen-18 isotope exchange studies, definite information was obtained about the mechanism of decarbonylation of formic acid, triphenylacetic acid and benzoylformic acid in concentrated sulfuric acid. The experimental results are in accord with previously proposed mechanisms of decarbonylation of formic and benzoylformic acids. In the case of the triphenylacetic acid decarbonylation, strong evidence is presented that a previously proposed mechanism is incorrect. A tentative mechanism for the decarbonylation of triphenylacetic acid which will account for the experimental observations was suggested. An oxygen-18 exchange between carbon monoxide and concentrated sulfuric acid was observed. A general discussion of isotopic methods which are applicable to the study of decarbonylation reactions and other similar reactions is included. Specific activity–per cent reaction curves that facilitate rapid computation of kinetic isotope effects are presented. (auth)

9399

TRAPPED FREE RADICAL CONCENTRATIONS. Charles E. Hecht (Univ. of Chicago). J. Chem. Phys. 32, 365-70 (1960) Feb.

Average concentrations of trapped free radicals condensed from a gaseous mixture are calculated on the basis of a statistical model that assumes these concentrations to be those in the solid for which the free radicals and diluents are distributed in such a way that the entropy of the system is a maximum. This entropy is calculated in an independent pair, Bethe approximation. All kinetic and energetic considerations are neglected. The results are given as a function of diluent concentration and of the number of nearest neighbors in the solid. When condensed from a completely dissociated gas without diluents the free

radical fraction ranges from 0.12 for a simple cubic lattice to 0.08 for a face-centered cubic lattice. (auth)

9400

ELECTRON SPIN RESONANCE STUDIES OF THE POTASSIUM SALT OF m-DINITROBENZENE NEGATIVE ION. Raymond L. Ward (Univ. of California, Livermore). J. Chem. Phys. 32, 410-16(1960) Feb.

A detailed analysis of the electron spin resonance spectrum for the potassium salt of m-dinitrobenzene negative ion in 1,2-dimethoxy-ethane (DME) is presented. Isotopic substitution was performed in various positions in the molecule. The m-dinitrobenzene negative ion exhibits only one nitrogen hyperfine interaction of 9.0 gauss, and possesses proton hyperfine interactions of 4.6 gauss for the number 2, 4, and 6 protons and 1.2 gauss for the number 5 proton. The hyperfine spectrum is different for each of the alkali metals, Li, Na, K, Rb, and Cs, but still retains only one nitrogen hyperfine interaction. An enriched Li^6 metal salt of m-dinitrobenzene indicates no alkali metal hyperfine interaction. (auth)

9401

NUCLEAR MAGNETIC RESONANCE STUDIES ON HYDRATION OF CATIONS. Jasper A. Jackson, Joe F. Lemons, and Henry Taube (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 32, 553-5(1960) Feb.

A preliminary study of the O^{17} NMR spectra of aqueous solutions has shown that it is possible to distinguish solvent water from water in the hydration sphere of certain cations. For certain ions the hydration water of which is sufficiently nonlabile (lifetime for exchange $>10^{-4}$ sec), it is possible to display the hydration water as a separate NMR peak when the solvent peak is shifted by addition of a paramagnetic ion. A method is suggested for determining the hydration number of such cations by measuring the change in the water available to interact with the paramagnetic ions due to water retained in the hydration sphere of the cations. The enrichment level of the O^{17} at present available does not permit precise determination of the hydration number, but the results are not incompatible with reasonable values. (auth)

9402

f^2 CONFIGURATION IN A CRYSTALLINE FIELD. Robert A. Satten and Jack S. Margolis (Univ. of California, Los Angeles). J. Chem. Phys. 32, 573-81(1960) Feb.

The matrix representation of a 4th and 6th degree octahedral potential in a complete basis of f^2LSJ functions belonging to a particular row of each of the 5 irreducible representations of the octahedral group O_h is presented. The matrices are 7×7, 3×3, two of 9×9, and 12×12 when spin-orbit and electrostatic interaction are included. Bases for the 5 irreducible representations are presented as linear combinations of M states for integral J values ranging from 0 to 6. Reduced matrix elements (independent of M or row of representation) are also given including a 2nd degree potential as well so that matrices for any other symmetry can readily be formed in the f^2 configuration. Sufficient information is given to define the phases of the states so that other interactions such as spin-orbit can readily be included. (auth)

9403

ION-MOLECULE CHARGE TRANSFER REACTIONS IN THE ALPHA RADIOLYSIS OF VARIOUS HYDROCARBONS IN A MASS SPECTROMETER. P. S. Rudolph and C. E. Melton (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 32, 586-8(1960) Feb.

The alpha-particle mass spectrometer proved to be a powerful tool for the study of charge transfer between gaseous ions and molecules. Energetically possible charge-transfer reactions were differentiated into probable and improbable reactions by employing binary mixtures of hydrocarbon gases in this instrument. The alpha-particle induced charge-transfer reaction, $C_2H_2^+ + C_6H_6 \rightarrow C_2H_2 + C_6H_6^+$, is shown to be very efficient. In contrast, the charge-transfer reaction, $C_2H_2^+ + C_2H_4 \rightarrow C_2H_2 + C_2H_4^+$, is shown to be inefficient. This inefficiency is discussed in terms of the competing chemical reaction, $C_2H_2^+ + C_2H_4 \rightarrow C_3H_3^+ + CH_3$. (auth)

9404

PARAMAGNETIC RESONANCE OF Ti^{3+}, Cr^{3+}, AND Fe^{3+} IN $AlCl_3 \cdot 6H_2O$. Eugene Y. Wong (Univ. of Chicago). J. Chem. Phys. 32, 598-600(1960) Feb.

Magnetic resonance of single crystals of $TiCl_3 \cdot 6H_2O$, $CrCl_3 \cdot 6H_2O$, and $FeCl_3 \cdot 6H_2O$ diluted with $AlCl_3 \cdot 6H_2O$ was observed. The results in each case were fitted to a spin Hamiltonian. The results indicate a large axial field for Ti^{3+} and Fe^{3+} but a small axial field for Cr^{3+}. (auth)

9405

VAPOR PRESSURES OF THE NEON ISOTOPES. Etienne G. Roth and Jacob Bigeleisen (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 32, 612(1960) Feb.

The vapor pressures of the neon isotopes were investigated at 16.4 to 30.1°K by differential manometry. The results were in agreement with those of Keesom and Haantjes. (C.J.G.)

9406

EXTREME VARIATIONS OF THE EMISSION SPECTRA OF DYSPROSIUM CHELATES. G. A. Crosby and R. E. Whan (Univ. of New Mexico, Albuquerque). J. Chem. Phys. 32, 614-15(1960) Feb.

The luminescence spectra of Dy^{3+} and Tb^{3+} ions in chelates with ligands derived from benzoylacetonate, dibenzoylmethide, and tribenzoylmethide were investigated. The data indicate that the triplet states of all the chelates which emit lines characteristic of the ion lie above the resonance level of that respective ion. (C.J.G.)

9407

THERMODYNAMIC PROPERTIES OF C_2. Robert L. Altman (Univ. of California, Berkeley). J. Chem. Phys. 32, 615-16(1960) Feb.

Recent spectroscopic data indicate the $^1\Sigma_g^+$ state of C_2 in about 610 cm^{-1} below the $^3\Pi_u$ state hitherto considered the ground state. Ballik and Ramsay have also obtained the molecular constants for a new $^3\Sigma_u^-$ state with excitation energy somewhat higher than the $^3\Pi_u$ state. The thermodynamic properties of C_2 were recalculated on the basis of this new data. The results are tabulated and composed with published tables of thermodynamic characteristics. (D.E.B.)

9408

COMMON ERROR MADE IN TREATING HYPERFINE EFFECTS IN ELECTRON PARAMAGNETIC RESONANCE STUDIES OF FREE RADICALS. Henry Zeldes, G. T. Trammell, Ralph Livingston, and R. W. Holmberg (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 32, 618-19 (1960) Feb.

Expressions are presented for the case of a single electron (or hole) in a completely quenched orbital (isotropic g factor) which has an axis of symmetry. Expressions are given for the case of a hybridized s−p orbital and it is shown that the angular dependence of the hyperfine splitting in the absence of s contributions is $(3\cos^2\theta + 1)^{1/2}$. (C.J.G.)

9409

ON THE ELECTRON SPIN RESONANCE SPECTRA OF

HYDROCARBON RADICALS. Peter G. Lykos (Argonne National Lab., Lemont, Ill. and Illinois Inst. of Tech., Chicago). J. Chem. Phys. 32, 625-6(1960) Feb.

McLachlan's form of valence-bond theory in the odd-electron model system for hydrocarbon radicals is extended to the model system of two nonrotating methylene groups sigma-bonded to a carbon atom in a $sp^2\pi$ valence state. The model is assumed to have C_{2v} symmetry and J(tp) is equated to $\frac{3}{4}$ J_0. In agreement with McLachlan, the expression for the expectation value of the spin density at a methylene proton for the ground state wave function for the perturbed system was determined as $\rho_H = 0.076$. The corresponding hyperfine splitting constant is 38 gauss. Assuming the bonds involving the odd carbon atom and the adjacent methylene groups in cyclopentyl and in cyclohexyl are not strained, the four equivalent protons should split the electron spin resonance line into five components with spacing 38 gauss and relative intensities 1:4:6:4:1. (C.J.G.)

9410

NMR STUDY OF ACETALDEHYDE–WATER MIXTURES. E. Lombardi and P. B. Sogo (Univ. of California, Berkeley). J. Chem. Phys. 32, 635-6(1960) Feb.

Acetaldehyde–water mixtures were studied by high-resolution NMR. The acetaldehyde spectrum was observed to consist of quadruplets at $\delta = -4.3$ and 0.7 and doublets at $\delta = 4.1$ and 5.0. The quadruplet at $\delta = 0.7$ and the doublet at $\delta = 5.0$ were assigned to the hydrated form. (C.J.G.)

9411

THE CONDITIONS FOR ELECTRODEPOSITION OF INSOLUBLE HYDROXIDES AT A CATHODE SURFACE: A THEORETICAL INVESTIGATION. P. G. Hansen ([Atomic Energy Commission] Research Establishment, Risø, Denmark). J. Inorg. & Nuclear Chem. 12, 30-37(1959) Dec.

The pH values obtained in the vicinity of a cathode surface where hydrogen evolution takes place are discussed using the concept of a diffusion layer. It is shown that a given current density I determines a hydrogen ion concentration C_{max} in the solution, above which no hydroxide deposition at the cathode can be expected to take place. The shape of the pH distribution makes it possible to define a hydroxyl ion layer, the thickness of which approaches zero as the hydrogen ion concentration approaches C_{max}. It is found that relatively high pH values (11 to 13) are easily obtained at a cathode surface, even in rather acid solutions. These results find some support in recent experimental work, but further data are desirable. (auth)

9412

OBSERVATIONS ON THE RARE EARTHS. LXX. SOME CHARACTERISTICS OF ETHYLENEDIAMINETETRAACETIC ACID, N-HYDROXYETHYLETHYLENEDIAMINETRIACETIC ACID, AND 1,2-DIAMINOCYCLOHEXANETETRAACETIC ACID CHELATES OF CERTAIN RARE-EARTH METAL IONS. T. Moeller and E. P. Horwitz (Univ. of Illinois, Urbana). J. Inorg. & Nuclear Chem. 12, 49-59 (1959) Dec.

$Ln(HEDTA) \cdot xH_2O$ and $Ba[Ln(DCTA)]_2 \cdot yH_2O$ chelates were isolated for neodymium, samarium, europium, gadolinium, and yttrium by precipitation with alcohols. X-ray-diffraction data show isomorphism within each series of compounds. Magnetic susceptibility data for several of these chelates and the corresponding ethylenediaminetetraacetate chelates indicate that the 4f electrons are not involved in bond formation. Absorption spectra data confirm this conclusion and indicate further that no correlation exists between alterations in absorption characteristics and chelate stability. Infra-red data and dehydration studies suggest that in $Ln(HEDTA) \cdot xH_2O$-type compounds, five coordination positions are occupied by the chelating agent and the sixth by water. (auth)

9413

THE PREPARATION, PHYSICAL PROPERTIES AND INFRA-RED SPECTRA OF SEVERAL NEW ORGANOPHOSPHONATES. D. F. Peppard, J. R. Ferraro, and G. W. Mason (Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 12, 60-70(1959) Dec.

The preparation, physical properties, and infrared spectra of several new organophosphonates [(G'O)GPO(OH)] are reported. Cryoscopic molecular weights in benzene show that these compounds are dimeric, and infrared studies of this association in carbon tetrachloride show no free OH absorption in the 3 μ region. The stronger hydrogen bonding in the organophosphorus compounds of the type $[(GO)_2PO(OH)]$, $[(GO)PO(OH)_2]$, $[GPO(OH)_2]$, $[(G'O)GPO(OH)]$, $[G_2PO(OH)]$, and [GHPO(OH)] as contrasted to the weaker bonding in monocarboxylic acids is discussed. (auth)

9414

SEXAVALENT COMPOUNDS OF URANIUM. I. URANYL ALKOXIDES AND URANIUM HEXA-ALKOXIDES. D. C. Bradley, Amar K. Chatterjee, and Amiya K. Chatterjee (Birkbeck Coll., London). J. Inorg. & Nuclear Chem. 12, 71-8(1959) Dec.

The preparation of uranyl alkoxides was complicated by either the insoluble nature of these compounds or their tendency to disproportionate. Insoluble uranyl methoxide, $UO_2(OMe)_2$, MeOH was obtained from the reaction involving uranyl chloride and methanolic lithium methoxide. Uranyl ethoxide $UO_2(OEt)_2$, 2EtOH was obtained similarly. Uranyl iso-amyloxide was obtained by the action of iso-amyl alcohol and ammonia on either uranyl chloride or dipyridinium uranyl chloride. The action of various alcohols on uranyl methoxide was studied and in some cases (mainly secondary and tertiary alcohols) a remarkable disproportionation occurred with the ultimate formation of uranium hexa-alkoxide $U(OR)_6$. Some properties of the hexa-alkoxides are described. The hexa-t-butoxide is remarkably resistant to hydrolysis. (auth)

9415

THE PREPARATION, PRESERVATION AND SEPARATION OF URANIUM TETRACHLORIDE AND URANYL CHLORIDE IN WATER, ETHANOL AND WATER–ETHANOL SOLVENTS. J. D. Hefley, D. M. Mathews, and E. S. Amis (Univ. of Arkansas, Fayetteville). J. Inorg. & Nuclear Chem. 12, 84-9(1959) Dec.

The sublimation of UCl_4 under argon and nitrogen is discussed. The former gave 99.42 per cent UCl_4 which yielded a stable solution free from colloid formation. The sublimation under nitrogen yielded a brownish-red material which had the combustibility and solubilities associated with the nitride but which was shown to be UO_2 by x-ray spectrum analysis. Both stabilities of the UCl_4 solutions and their analyses for uranium by the use of cupferron are discussed for both water and ethanol solvents. The preparation of pure $UO_2Cl_2 \cdot H_2O$ is described, and the stability data for UO_2Cl_2 solutions in water, ethanol and water-ethanol solvents are presented. The cupferron method of separation of U(IV) and U(VI) was found to be as effective. (auth)

9416

OBSERVATIONS ON REACTIONS OF URANIUM COMPOUNDS. H. J. Borchardt (General Electric Co., Schenectady, N. Y.). J. Inorg. & Nuclear Chem. 12, 113-21 (1959) Dec.

The reaction of U_3O_8, uranium carbide, and uranium boride, each respectively, with the metals Fe, Ni, Cr, and Nb were investigated with thermoanalytical techniques and x-ray analysis. The air oxidation of uranium carbide and boride as well as the interaction between UO_2, U_3O_8, and Cr_2O_3 was briefly examined. It was found that all the above metals reduce U_3O_8 rapidly well below 1000°C. No interaction between uranium carbide and said metals was observed. Only Ni was found to react with uranium boride with the formation of an unidentified phase. The mechanisms of U_3O_8 reduction and uranium carbide and boride oxidation are discussed in light of the data. New phases resulting from interaction of Cr_2O_3 with U_3O_8 and the oxidation of uranium boride are reported. (auth)

9417

SOME METAL COMPLEXES OF CITRIC AND TRICARBALLYLIC ACIDS. N. C. Li, A. Lindenbaum, and J. M. White (Argonne National Lab., Lemont, Ill. and Duquesne Univ., Lemont, Ill.). J. Inorg. & Nuclear Chem. 12, 122-8 (1959) Dec.

The formation constants of several metal complexes of citrate and tricarballylate, and of the "hydrogen complexes," i.e., complexes in which HA^{2-} act as ligands, were determined by a titrimetric method. For Mn(II), Cd(II), Zn(II), and Ni(II) complexes of citrate, the value of K_{MA}/K_{MHA} varies from $10^{1.6}$ to $10^{1.9}$, the ratio increasing with increasing value of K_{MA}. The citrate complexes are more stable than the corresponding tricarballylate complex, as expected. The Co(II) and Mg complexes of citrate have reduction potentials which are too negative for direct polarographic method. In the pH region 1.9 to 2.5 the 1:1 uranyl-citrate complex has been shown to be a monomer with log K_{MA} = 8.5. (auth)

9418

TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING AGENT FOR INORGANIC NITRATES. VII. THE TRIVALENT ACTINIDE NITRATES. G. F. Best, E. Hesford, and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 12, 138-40(1959) Dec.

The trivalent actinide nitrates resemble the trivalent lanthanide nitrates in their extractability by tri-n-butyl phosphate (TBP). The resemblance is especially close for elements of the same ionic radius. In both series the element with a half-filled f-shell (Gd or Cm) is rather less extractable than might have been expected from the behavior of its neighbors. (auth)

9419

THE COMPLEXING OF TETRAVALENT URANIUM WITH DIALKYLPYROPHOSPHORIC ACID. D. Grdenić (University, Zagreb) and B. Korpar (Inst. Rudjer Bošković, Zagreb). J. Inorg. & Nuclear Chem. 12, 149-53(1959) Dec.

The extraction of uranium(IV) ions into a ligroin solution of dialkylpyrophosphoric acid from aqueous sulfuric acid solution was investigated. It was established that the extractable species is a complex compound defined by formula $U(R_2HP_2O_7)_4$. It may be considered as an addition product of two molecules of the reagent to one molecule of uranium(IV) dialkylpyrophosphate. The uranium(IV) dialkylpyrophosphates $U(R_2P_2O_7)_2$ for R = ethyl, i-propyl, n-butyl, n-octyl were also isolated as green powders insoluble in water, acids, and organic solvents but soluble in dialkylpyrophosphoric acid solutions. The properties of the compounds described were explained by assuming that in their structure uranium occurs in co-ordination eight. (auth)

9420

NITROSYLRUTHENIUM NITRATO COMPLEXES IN AQUEOUS NITRIC ACID. J. M. Fletcher, P. G. M. Brown, E. R. Gardner, C. J. Hardy, A. G. Wain, and J. L. Woodhead (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 12, 154-73(1959) Dec.

Paper chromatographic and ion exchange studies of nitrosylruthenium nitrato complexes in 0.1 to 14.5 M nitric acid have enabled the complexes to be separated into four groups in order of increasing complexing from the mononitrato to the pentanitrato complex, $H_2RuNO(NO_3)_5$. The eleven nitrato complexes which can be formulated assuming a regular octahedral arrangement around the hexacoordinated ruthenium were allocated to these groups. Absorption spectra and compositions are presented for equilibrium mixtures of the complexes in nitric acid and the successive formation constants for nitrato complexing of nitrosylruthenium were calculated. Other measurements include the rates of one of the denitration reactions at 0° and 25° and the ruthenium distribution coefficients after prolonged contact of solutions in 0.5 to 10 M nitric acid with an anion exchange resin. In contrast to other metal nitrates, tributyl phosphate extracts preferentially the tetra- and pentanitrato acids rather than the uncharged trinitrato complex. (auth)

9421

THE ADSORPTION OF INORGANIC SALTS BY AMINE RESINS FROM ORGANIC SOLVENTS. J. Kennedy and R. V. Davies (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 12, 193-8(1959) Dec.

The adsorption of lithium, cupric, and cobaltous chlorides, and of nickel nitrate from organic solvents by anion-exchange resins was investigated. Adsorption by the basic form of the tertiary amine resin Deacidite H takes place through complex formation with the resin functional groups, and both cation and anion are adsorbed in equivalent proportions. Increased crosslinking (per cent nominal divinyl benzene) of Deacidite H from 1 to 9 per cent has little effect on the uptake of lithium chloride, but a significant reduction is observed in cobalt chloride adsorption for crosslinking greater than 2 per cent. Adsorption is influenced by the nature of the solvent, and is much greater from acetone than from dimethyl formamide. (auth)

9422

KINETICS OF OXIDATION-REDUCTION REACTIONS OF PLUTONIUM. THE REACTION BETWEEN PLUTONIUM (IV) AND TITANIUM (III) IN PERCHLORATE SOLUTION. S. W. Rabideau and R. J. Kline (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 64, 193-6(1960) Feb.

The kinetics of the reaction between Pu(IV) and Ti(III) was studied by following the rate of disappearance of Pu(IV) spectrophotometrically at 4695 Å. The rate law for the reaction can be written: $-d[Pu(IV)]/dt = -d[Ti(III)]/dt = k_1[Pu^{+4}][Ti^{+3}][H^+]^{-1}$. From a study of the temperature coefficient of the reaction rate in molar perchloric acid solutions of ionic strength 1.02, the thermodynamic quantities associated with the activation process were calculated in terms of the principal species. At 25° they were calculated to be: $\Delta F^{\ddagger}$ = 15.0 ± 0.1 kcal/mole, $\Delta H^{\ddagger}$ = 16.7 ± 0.72 kcal/mole and $\Delta S^{\ddagger}$ = 5.9 ± 2 eu. The reaction between Ti(III) and perchlorate ion was considered and the effect of chloride ion on the rate of reaction between Pu(IV) and Ti(III) was found to be negligible. (auth)

9423

ADSORPTION STUDIES ON CLAY MINERALS. VII. YTRRIUM–CESIUM AND CERIUM (III)–CESIUM ON

MONTMORILLONITE. Galen R. Frysinger and Henry C. Thomas (Yale Univ., New Haven). J. Phys. Chem. 64, 224-8(1960) Feb.

Exchange-adsorption of cesium and the nominally tripositive ions of yttrium and cerium on Chambers, Arizona, montmorillonite (from solutions of the nitrates) was studied at different concentrations and temperatures. The isotherms obtained with the two trivalent ions are closely similar but are very much more complicated in character than those previously found for ions of lower charge. Reversals in selectivity occur at compositions which depend on total concentration and temperature. The average charge of the sorbed trivalent ions is shown to be nearly three. Thermodynamic data for the exchange reactions are computed. The composition of the clay as regards the sorbed species is independent of the pH of the equilibrating solution over a wide range (3–4 pH units). (auth)

9424

CRYOSCOPIC STUDIES IN THE MOLTEN BISMUTH–BISMUTH CHLORIDE SYSTEM. S. W. Mayer, S. J. Yosim, and L. E. Topol (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Phys. Chem. 64, 238-40(1960) Feb.

A series of freezing point depression measurements were made in the metal-rich and salt-rich regions of the Bi–$BiCl_3$ system. $BiCl_3$ was found to have a cryoscopic effect of 3.02 ± 0.07 when dissolved in molten bismuth. This effect can be explained by dissociation of $BiCl_3$ solute or by reaction of $BiCl_3$ with Bi to form the monochloride. In the case of the salt-rich region, the results suggest that Bi dissolves in $BiCl_3$ as Bi_2Cl_2. (auth)

9425

THE KINETICS OF THE REACTION BETWEEN Pu(IV) AND Fe(II). T. W. Newton and H. D. Cowan (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 64, 244-7(1960) Feb.

The kinetics of the reaction between Pu(IV) and Fe(II) was studied in perchlorate media containing up to 0.10 M chloride. The rate law indicates that the most important activated complexes are formed from water, Pu^{4+}, and Fe^{2+} with the prior loss of one hydrogen ion, and from Pu^{4+}, Fe^{2+}, and Cl^-. The formulas and the heats, free energies and entropies of formation of these activated complexes from the principal reactants were found to be: $(Pu \cdot OH \cdot Fe^{5+})^{\ddagger}$, $\Delta H^{\ddagger}$ = 19.1 kcal/mole, $\Delta F^{\ddagger}$ = 15.1 kcal/mole, and $\Delta S^{\ddagger}$ = 13.3 e.u.; and $(Pu \cdot Cl \cdot Fe^{5+})^{+}$, $\Delta H^{\ddagger}$ = 14.4 kcal/mole, $\Delta F^{\ddagger}$ = 14.2 kcal/mole, and $\Delta S^{\ddagger}$ = 0.6 e.u. The relation between the kinetics of this reaction and similar ones is discussed. Small amounts of H_2SO_4 were found greatly to accelerate the reaction. (auth)

9426

THE HEAT OF FUSION OF THE ALKALI METAL HALIDES. A. S. Dworkin and M. A. Bredig (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 269-72(1960) Feb.

The heat of fusion of seventeen alkali halides was measured by means of a copper block drop calorimeter. The salts and their heats of fusion in kcal $mole^{-1}$ are as follows: LiCl, 4.76; LiBr, 4.22; LiI, 3.50; NaCl, 6.69; NaBr, 6.24; NaI, 5.64; KCl, 6.27; KBr, 6.10; KI, 5.74; RbF, 6.15; RbCl, 5.67; RbBr, 5.57; RbI, 5.27; CsF, 5.19; CsCl, 4.84; CsBr, 5.64; and CsI, 5.64. The heats of fusion are believed to be accurate to at least ±1 to 2%. Except for the Li salts and, to some slight extent, the sodium salts, the entropy of fusion is constant when the anion varies, but decreases with increasing atomic number of the cation. (auth)

9427

CHEMICAL KINETICS OF THE ZIRCONIUM–HYDROFLUORIC ACID REACTION. W. J. James, W. G. Custead, and M. E. Straumanis (Univ. of Missouri, Rolla). J. Phys. Chem. 64, 286-8(1960) Feb.

Studies were conducted in order to extend dissolution data above 0.5 N HF using pressure measurements of evolved hydrogen for rate determinations, to determine the effect of temperature on rate, to investigate the effect of noble salt additions to the acid, and to explain the mechanism of dissolution. Rate data for HF concentrations up to 3 N are plotted and discussed. (B.O.G.)

9428

ANION-EXCHANGE STUDY OF THE URANYL FLUORINE COMPLEXES. T. R. Bhat and Y. W. Gokhale (Atomic Energy Establishment, Trombay, India). J. Sci. Ind. Research (India) 18B, 532-3(1959) Dec.

The addition of fluoride ions to solutions of uranium(VI) rapidly increases adsorbability of the latter by anion-exchange resins of the quaternary ammonium type. Conductometric and spectrophotometric investigations indicated that there are formed two uranyl fluoride anion complexes, $UO_2F_3^-$ and $UO_2F_4^{2-}$. The nature of the ion adsorbed by Amberlite IRA-400 was investigated. The results showed that during adsorption, uranium and fluoride are taken up in the molar ratio 1 : 2, suggesting that the complex on the resin is of the type $UO_2F_n^{2-n}$ where n > 2. If only one species of the complex ion is adsorbed, the value for n can be easily determined by measuring the saturation capacity of the resin for the ion. The capacity is reduced by a factor of 2 when $UO_2F_4^{2-}$ is adsorbed instead of $UO_2F_3^-$. The method of the investigation and the results are presented. (B.O.G.)

9429

EVIDENCE FOR THE EXISTENCE OF A POTASSIUM RHENIUM HYDRIDE AND ITS BEARING ON THE NATURE OF THE (–1)-OXIDATION STATE OF RHENIUM. A. P. Ginsberg, J. M. Miller, J. R. Cavanaugh, and B. P. Dailey (Columbia Univ., New York). Nature 185, 528-9(1960) Feb. 20.

Observations are reported on the product of the reduction of potassium perrhenate with potassium metal in ethylenediamine–water solution. The observations demonstrate the existence of a soluble rhenium hydride. (C.H.)

9430

NATURAL RADIOACTIVITY OF SAMARIUM AND NEODYMIUM. M. Karras and M. Nurmia (Univ. of Helsinki). Nature 185, 601(1960) Feb. 27.

Thin samples containing about 50 $\mu gm/cm^2$ of natural samarium, 0.3 $\mu gm/cm^2$ of natural uranium, and 0.5 $\mu gm/cm^2$ of elemental boron were analyzed in a grid-type ionization chamber in the presence of a thermal nuclear flux of 1.5×10^3 n/cm^2 obtained from a polonium-beryllium source. The neutrons absorbed by boron gave rise to alpha particles with energies of 1.797 and 1.474 Mev, respectively, which were recorded photographically together with the samarium and uranium alpha particles for the purposes of calibration. By the use of exposures several days long, spectra containing 10^4 to 10^5 pulses were obtained and analysed with a spectrophotometer. The result for the alpha energy of samarium-147 is E = 2.20 ± 0.03 Mev. The specific activity of samarium-147 was measured by counting the alpha particles from 28.9 mgm of samarium which were vacuum-evaporated on a source plate of diameter 200 mm. Taking into account self-absorption and back-scattering, a value of 7.00 ± 0.3 counts/min/mgm of natural samarium is obtained, which corresponds to a half-life of 1.14 ± 0.05 ×

10^{11} yr. for the isotope 147. An attempt to detect the natural alpha activity of neodymium was made using a 200-mm source plate on which 36 mgm of neodymium were evaporated. In spite of appreciable thorium contamination a weak line was observed at 2.0 ± 0.1 Mev., in agreement with investigations made by the emulsion method. (auth)

9431

CARBONATES OF URANIUM. Balaram Sahoo and D. Patnaik (Utkal Univ., Cuttack, India). Nature 185, 683(1960) Mar. 5.

A simple and convenient method is described for the preparation of uranyl carbonate. One step in the preparation involves the preparation of uranium(IV) oxycarbonate, a hitherto unreported uranium compound. (C.H.)

9432

VAPOR PRESSURE OF URANYL NITRATE HYDRATES. V. M. Vdovenko and A. P. Sokolov. Radiokhimiya 1, 117-20(1959). (In Russian)

The vapor pressures for the hexahydrate, the trihydrate, and the dihydrate of uranyl nitrate were measured at 20 to 60°C. The vapor pressure of water in the system $[UO_2(NO_3)_2 \cdot 3H_2O] - UO_2(NO_3)_{2aq} - (H_2O)$ was measured for the temperature interval 60 to 70°C. The enthalpy, free energy, and entropy were calculated from the experimental data on vapor pressures. (R.V.J.)

9433

URANYL NITRATE COMPLEXES WITH ORGANOPHOSPHORUS COMPOUNDS. V. G. Voden, G. P. Nikitina, and M. F. Pushlenkov. Radiokhimiya 1, 121-30(1959). (In Russian)

The compositions of uranyl complexes with dibutyl ether butyl phosphinic acid (DBEBP) and with tributyl phosphinic oxide (TBPO) were found to correspond to the general formula $UO_2(NO_3)_2 \cdot 2T$, where T indicates one mole of the complexing agent. The order of the instability constant was established as 12 for $UO_2(NO_3)_2 \cdot 2TBP$ and as 9.5×10^2 for $UO_2(NO_3)_2 \cdot DBEBP$. The instability constant for $UO_2(NO_3)_2 \cdot 2TBPO$ was calculated as 3.8×10^6. The increase in the value of the stability constant as $(C_4H_9O)_3PO \rightarrow (C_4H)_3PO$ indicates that the phosphoryl group plays the principal role in complex formation. 16 references. (R.V.J.)

9434

STABILITY OF HEXAVALENT PLUTONIUM IN AQUEOUS SOLUTIONS. L. E. Drabkina and A. D. Gel'man. Radiokhimiya 1, 136-40(1959). (In Russian)

Pu^{6+} is stable in 1N HNO_3 for one week or longer. Pu^{6+} is reduced to a lower valence state by oxalates, particularly at lower acidities. (R.V.J.)

9435

INVESTIGATION OF OXALATE AND EDTA COMPLEXES OF TRIVALENT AMERICIUM BY ION EXCHANGE. A. I. Moskvin, G. V. Khalturin, and A. D. Gel'man. Radiokhimiya 1, 141-6(1959). (In Russian)

The distributions of trace amounts of Am^{3+} between the cation exchanger KU-2 and 1M NH_4Cl at various pH values, with and without a complexing agent, show formation of the complexes $[Am(C_2O_4)_2]^-$, $[Am(HC_2O_4)_3]^0$, and $[Am(HC_2O_4)_4]^-$ with respective instability constants of (1 to 2) × 10^{-10}, 2.3×10^{-10}, and 1.0×10^{-11}. Similiarly, at a pH of 1.0 to 2.2, the complexes $[Am\ Y]^-$ and $[Am\ HY]^0$ are formed in ethylenediaminetetraacetic (EDTA) solutions with corresponding instability constants $(9.7 \pm 2.8) \times 10^{-19}$ and $(2.0 \pm 0.5) \times 10^{-19}$. The calculations used in determining the compositions and instability constants of the oxalate and EDTA complexes of Am^{3+} are similar to those applied in determining the analogs of Pu^{3+} complexes. (R.V.J.)

9436

TRILON B COMPLEXES OF BARIUM AND RADIUM IN SOLUTION. B. P. Nikol'skii, A. M. Trofimov, and N. B. Vysokoostrovskaya. Radiokhimiya 1, 147-54(1959). (In Russian)

Anion radium and barium complexes $[RaA]^{2-}$ with Trilon B are formed at pH 5.5 to 6.9 as determined by using the tracers Ba^{140} and Ra^{226} and noting their distributions between a cation exchanger and a solution with and without the complexing agent. The composition of the complex barium anion $[BaA]^{2-}$, as established by Schwartzenbach, was confirmed. The formation of Ra and Ba complexes begins at a pH of about 4.5, while at a pH 78, no significant amounts of free Ba or Ra ions can be detected. The instability constant for the Ba complex was found to be pK = 7.69, which agrees with Schwartzenbach value of pK = 7.76 (potentiometric method) and with that of Schemid and Reilery of pK = 7.90 (polarographic method). The Ba complex (pK = 7.69) was found to be somewhat stronger than the corresponding Ra complex (pK = 7.12). 58 references. (R.V.J.)

9437

RADIUM AND BARIUM NITRILOTRIACETIC ACID (NTA) COMPLEXES IN AQUEOUS SOLUTION. B. P. Nikol'skii, A. M. Trofimov, and N. B. Vysokoostrovskaya. Radiokhimiya 1, 155-61(1959). (In Russian)

In studying the distributions of trace amounts of Ba^{140} and Ra^{226} between the cation exchanger KU-2 and a solution with and without a complexing agent over a pH range 4 to 8, it was established that anionic nitrilotriacetate complexes of the type $[RaX]^-$ are formed at pH of 6 to 8; X is the NTA anion. The composition of the anionic barium complex, as established by Schwartzenbach, was confirmed. Formation of this complex in significant amounts (> 5%) begins at a concentration of complexing agent (X^{3-} ions) of about 4×10^{-6} moles/l and at a concentration of complexing agent of 2×10^{-5} moles/l; the concentration of free barium in solution is less than 5% of the total concentration of barium. The corresponding concentrations of complexing agent for radium are 10^{-7} moles/l and 5×10^{-5} moles/l. Instability complexes of $pK_{Ra} = 5.75$ and $pK_{Ba} = 6.17$ (Schwartzenbach found $pK_{Ba} = 6.41$) were calculated from the experimental data. These values indicate that the barium complex is somewhat stronger than the radium complex. (R.V.J.)

9438

DETERMINATION OF INSTABILITY CONSTANTS OF MICRO-CONCENTRATIONS OF A COMPLEX BY ELECTROMIGRATION. THE INSTABILITY CONSTANTS OF SOME OF THE LANTHANIDE COMPLEXES WITH ETHYLENEDIAMINETETRACETIC ACID (EDTA). V. P. Shvedov and A. V. Stepanov. Radiokhimiya 1, 162-7(1959). (In Russian).

A new electromigration method was applied to the determination of the instability constant of micro amounts of a complex. The method consists of determining the relationship between the shift in equilibrium for the break-up of the complex and the rate of total metal transferred in an electric field. The instability constants for EDTA complexes of La, Ce, Pm, Eu, and Y were determined by this method. Comparisons of the values obtained with values determined potentiometrically for La, Ce, Eu, and Y are in satisfactory agreement. The instability constant for the promethium EDTA complex was determined for the first time by this method. (R.V.J.)

9439

THE STATE OF MICRO-AMOUNTS OF A RADIOELEMENT IN DILUTE SOLUTIONS. VII. ADSORPTION AND DESORPTION OF PROTACTINIUM IN AQUEOUS SOLUTION. I. E. Starik, L. D. Sheidina, and L. I. Il'menkova. Radiokhimiya 1, 168-70(1959). (In Russian)

Adsorption of protactinium on quartz from nitric acid solutions in the pH range 1 to 14 showed that maximum adsorption occurs at pH = 5 to 5.2. The adsorption and desorption curves for aqueous solutions indicate that ionic forms of protactinium predominate at low pH (below 4 to 4.5) and colloidal forms at pH 7.5. The solubility product of $Pa(OH)_5$ is 10^{-55} at a protactinium concentration of 10^{-12} moles/l. (R.V.J.)

9440

THE STATE OF MICRO-AMOUNTS OF A RADIOELEMENT IN DILUTE SOLUTION. VIII. ADSORPTION OF LANTHANUM ON QUARTZ AND PLEXIGLAS. I. E. Starik and F. L. Ginzburg. Radiokhimiya 1, 171-3(1959). (In Russian)

Maximum adsorption of La on quartz and Plexiglas occurs at a pH close to 7 and a La concentration of 10^{-14} moles/l. The adsorption of micro-amounts of La on Plexiglas is significantly greater than the adsorption on glass. The maximum adsorption of La on quartz occurs at pH = 7 to 8 and a La concentration of 10^{-7} moles/l. (R.V.J.)

9441

ADSORPTION OF ZINC AND CERIUM ON BARIUM SULFATE AND LEAD SULFATE. A. P. Ratner, V. R. Klokman, and A. B. Nikol'skii. Radiokhimiya 1, 174-80(1959). (In Russian)

The fraction of the surface of a crystalline $BaSO_4$ precipitate occupied by competing charged particles was found to be approximately 2%, as determined by the adsorption of Zn^{65}. The surface of $BaSO_4$ was found to be 14.2 ± 2.6 μg of SO_4^{2-} ions per gram of $BaSO_4$ and 3.47 ± 0.02 μg of SO_4^{2-} ions per gram of $PbSO_4$, as determined by the use of S^{35} tracer. Cerium adsorption isotherms were determined for negatively charged crystalline suspensions of $BaSO_4$ and $PbSO_4$. Part of the cerium is adsorbed irreversibly. (R.V.J.)

9442

CRYSTALLOGRAPHIC CHARACTERISTICS AND SPECTROGRAMS OF POWDERED ANHYDROUS URANIUM AND THORIUM METAPHOSPHATES. Aurelio Burdese and Maria Lucco Borlera (Istituto di chimica generale e applicata e di metallurgia del Politecnico, Turin) Ricerca sci. 30, 103-8(1960) Jan. (In Italian)

The isomorphic anhydrous uranium and thorium metaphosphates crystallize in the rhombic system. The elementary cells containing 8 molecules of the corresponding compounds, are characterized by the following lattice constants: Th (PO): a = 14.35 A; b = 15.11 A; c = 9.05 A. U (PO): a = 14.33 A; b = 14.96 A; c = 9.05 A. (auth)

9443

ORGANIC COMPLEXES OF TITANIUM. A. L. Suvorov and S. S. Spasskii (Inst. of Chemistry, Urals Branch of the Academy of Sciences, USSR). Uspekhi Khim. 28, 1267-1309(1959) Nov. (In Russian)

Complexes of Ti–C bonds, radical complexes in which Ti is bound by oxygen, nitrogen, etc., and coördinated complexes of titanium with organic molecules were studied. 274 references. (R.V.J.)

9444

PRODUCTION OF AQUEOUS URANIUM SULPHATE SOLUTIONS. (to United Kingdom Atomic Energy Authority). British Patent 829,090. Feb. 24, 1960.

A process for dissolving U oxides in H_2SO_4 is given in which a metal fluoride is used to accelerate the reaction. The process can also be applied to slag or roasted dross from a fluoride process. In an example, a slag (30.5% U, 55% CaF_2, and MgF_2) was heated with 20% H_2SO_4 at 85 to 95°C for 1 hr. The U was completely dissolved. In another example, a U_3O_8 product which did not yield to a 12% H_2SO_4 treatment for 1¾ hours at 85 to 95°C was completely dissolved when 2 grams of CaF_2 were added and the heating continued for 1 hour. (T.R.H.)

9445

THE PRODUCTION OF URANIUM AND URANYL SULPHATE. (to United Kingdom Atomic Energy Authority). British Patent 829,091. Feb. 24, 1960.

A method is given for recovering U from bomb reduction slags. The crushed slag is roasted and moistened with concentrated H_2SO_4 and heated. In an example 100 parts of slag containing 44% F, 29% Mg, 21% U, 4% C, and 2% O are crushed and roasted at 700 to 800°C for 4 hours, cooled, and ground to 200 mesh. Then it is mixed with 300 parts of 98% H_2SO_4 and heated at 250°C until no more HF is evolved. The resulting sludge is F free and contains all the U in acid-soluble form. Addition of 500 parts of H_2O, air bubbling, and addition of H_2O_2 caused oxidation to UO_2SO_4. Heating to 90 or 95°C decomposed peroxides. The pH is then adjusted to 3.7 and heated to 95 to 100°C to precipitate Fe. Filtration removes precipitates. (T.R.H.)

9446

CARBONATES OF OCTAVALENT URANIUM AND ALKALI METALS OR AMMONIUM. (to United Kingdom Atomic Energy Authority). British Patent 829,092. Feb. 24, 1960.

A method is presented for producing water-soluble octavalent U compounds from uranium peroxide so that insoluble impurities can be removed. In an example 100 g of uranium peroxide filter cake was mixed with 70 g $NaHCO_3$ and 80 g of H_2O at 60°C for 30 min. Raising the temperature to 70°C for 30 min completely dissolved the solids. After filtration, 895 of the 945 cc of filtrate was heated to 40 to 45°C and 29 cc of 96% H_2SO_4 added along with 19 cc of 28% H_2O_2 and 30 cc of aqueous 30% NaOH. The uranium peroxide precipitate, when filtered and dried, weighed 65 g and contained 0.15% F. (T.R.H.)

9447

RECOVERY OF URANIUM BY PRECIPITATION AS PEROXIDE. (to United Kingdom Atomic Energy Authority). British Patent 829,093. Feb. 24, 1960.

Uranium recovery from uranyl sulfate solutions by peroxide precipitation is described. Boric acid is used to inhibit fluoride precipitation. In an example, a roasted slag was dissolved in H_2SO_4 by a process described in patent No. 829,088, the pH adjusted to 3.7. After adding boric acid the U peroxide was precipitated by adding H_2O_2 and NaOH to pH at 3.0. The fluorine content of the precipitate was 0.5% compared to 2gm/liter in the original solution. (T.R.H.)

9448

PRODUCTION OF URANIUM PEROXIDE. (to United Kingdom Atomic Energy Authority). British Patent 829,094. Feb. 24, 1960.

A process for precipitating UO_4 from UO_2SO_4 solutions produced by the process described in patent No. 828,088 is presented. The precipitation takes place in the presence of $(NH_4)_2SO_4$ to inhibit fluoride precipitation. (T.R.H.)

Analytical Procedures

9449 AECU-4713

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

NEUTRON ACTIVATION ANALYSIS. A Literature Search

E. U. Kauer. Feb. 1960. 6p. Contract AT(07-2)-1. OTS.

Fifty-seven references are presented on methods of neutron activation analysis. The references are grouped as journal articles, books, papers, and documents. (W.L.H.)

9450 CEA-1094

France. Commissariat à l'Énergie Atomique, Paris.

CONTROLE DE PURETE DU GRAPHITE ET DE L'EAU LOURDE. (Measurement of the Purity of Graphite and Heavy Water). H. Hering. Feb. 1959. 32p.

Analytical methods used by the C.E.A. are described. The determination of the change in the neutron capture cross section of graphite from sample to sample is determined by an oscillation method in the ZOE reactor, or by measuring the attenuation of a neutron flux in the subcritical system Mireille. Methods of analyzing total ash, B, H, Cl, Na, Ca, Fe, Mo, Ti, V, Sm, Eu, Dy, S, Co, and Cd are described and mean results are given. The methods for sampling are indicated. The isotopic analysis of heavy water is carried out by infra-red absorption measurements. Chemical purity is evaluated by electrical conductivity measurements, B, Na, Mg, K, Cr, Mn, Ni, Cu, and Cd, are determined by spectrographic methods, and Cl^-, NO_3^-, SO_4^{--}, NH_4^+ by chemical methods; finally, sensitive pH measurements are described. (auth)

9451 CI-R-76

Gt. Brit. Springfields Works, Springfields, Lancs, England.

AN APPRECIATION OF THE POSSIBILITIES OF DETERMINING URANIUM ISOTOPE ABUNDANCE BY EMISSION SPECTROGRAPHY. A. L. Wilson and T. H. Boyd. Nov. 1953. 20p.

The spectral line intensity of U^{235} in uranium at the 1 Co and 20 Co levels was studied. Experiments were performed using a grating spectrograph in the 2nd order and employing photographic recording. It is shown that at the 20 Co level by comparing the intensities of U^{235} and U^{238} isotope lines, the abundance ratio can be estimated with a standard deviation of $0.3/\sqrt{n}$, based on the mean of n replications. The experimental result on a sample agreed, within experimental error with those obtained by mass spectrometer and radioactivation methods. At the 1 Co level, a U^{235} isotope line was compared with an unshifted U line of comparable intensity and the best standard deviation which could be obtained was $0.08/\sqrt{n}$ based on the mean of n replications. (auth)

9452 HW-62188

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE DETERMINATION OF ZIRCONIUM-95 PLUS NIOBIUM-95 BY ANION EXCHANGE SEPARATION FROM OTHER FISSION PRODUCTS. A. C. Leaf. Oct. 5, 1959. 16p. Contract AT(45-1)-1350. OTS.

An anion exchange method is described for the separation of Zr^{95} and Nb^{95} from other fission products. The zirconium and niobium are adsorbed onto Dowex-1 resin in the fluoride form from a hydrofluoric acid solution of the fission products. The resin is counted directly using a three-inch NaI(Tl) well crystal and a gamma scintillation spectrometer. Yields of >99.5% are obtained. The activity levels of the major fission products Ru^{106}, Cs^{137}, and Ce^{144} are reduced by >95%. (auth)

9453 NYO-4700

New York Operations Office. Health and Safety Lab., AEC.

HASL MANUAL OF STANDARD PROCEDURES WITH REVISIONS AND MODIFICATIONS TO AUGUST 1959. Ira B. Whitney, ed. Feb. 1960. 175p. OTS.

A manual containing analytical methods that are used currently by the Health and Safety Laboratory U.S.A.E.C. is presented. Useful miscellaneous data related to fall-out radiochemistry are also included. (J.R.D.)

9454 NYO-7568

Boston Univ.

ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF URANIUM. Separation of Uranium from Bismuth Using Tris-(2-ethylhexyl)phosphine Oxide. Work completed, May 1958. Arno H. A. Heyn and Gurupada Banerjee. Nov. 1, 1959. 25p. Contract AT(30-1)-1873. OTS.

An ultraviolet spectrophotometric method for the determination of uranium was developed which is based on the ultraviolet absorption of the complex of uranium(VI) with tris-(2-ethylhexyl)phosphine oxide (TEHPO). The complex is formed by extracting uranium(VI) from an aqueous 6M sodium nitrate solution in the pH range 2.5 to 3.0 into 0.1M solution of TEHPO in an inert diluent, cyclohexane. This extraction also separates the uranium from many diverse ions that otherwise interfere. The reliable range for aqueous samples is 0.0025 to 0.1 mg of uranium per ml. The standard deviation is less than 1% for both 0.05 mg uranium per ml of the organic phase for 1-cm cells and 0.005 mg per ml for 5-cm cells. Extraction of uranium from 7M nitric acid with 0.1M TEHPO, followed by stripping with sodium carbonate solution, was successfully utilized to develop a method for the separation of uranium from 10,000-fold excess of bismuth. (auth)

9455 ORNL-2866

Oak Ridge National Lab., Tenn.

ANALYTICAL CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1959. Feb. 18, 1960. 110p. Contract W-7405-eng-26. OTS.

RESEARCH AND DEVELOPMENT. The following work was done in the In-Line Instrumentation Development program. A recording, high-sensitivity, controlled-potential, a-c polarograph was designed and constructed. This polarograph is being evaluated and will be applied to the determination of uranium(VI) in solutions of low uranium concentration. A test loop for the investigation of the behavior of electrolytes in high concentrations and at frequencies up to 2000 Mc/sec has been built for radio-frequency monitor development. Further study of the monitoring of uranium in radioactive streams is planned with a chopped-single-gamma-beam technique and with a dual-beam instrument. Developments in analytical instrumentation were as follows. A new high-resolution, high-sensitivity, scanning, recording flame spectrophotometer is being built. An electronic polarographic scanning circuit has been designed that has better performance than the usual motor-driven potentiometer scanner. A spectrographic intensity-ratio analog computer has been designed and installed. The computer is being tested for the rapid spectrographic determination of oxygen in steels. A plastic-lined pipet is being designed that can be installed in the remotely servo-controlled pipetter. A program for the preparation of trimethyl borate containing B^{10} from boron trifluoride etherate containing B^{10} is in progress. The high-purity lithium iodide program for the Neutron Physics Division and the fused salts program for the Metallurgy Division were continued. A coulometric titration method was developed for the precise determination of plutonium. Two solvent extraction methods of separation of uranium(VI) prior to its coulometric determination have been studied. Polarographic and coulometric studies of neptunium have been started. A polarographic determination of technetium in uranyl oxide has been developed. A study was made of chemical changes in uranium trioxide–aluminum reactor fuel elements during heat treatment. Spectrophotometric studies of aqueous solutions of uranium, copper, and nickel

were continued. The Oracle was used to resolve mathematically the uranyl ion spectral fine structure and to study the complexation of uranyl ion with sulfate. Spectral studies of scintillation crystals of europium-activated lithium iodide were continued. A spectrophotometric method was developed for the determination of iron in concentrated solutions of zinc bromide. The gas chromatography work has continued and studies were made of mixtures of nitric oxide, nitrogen dioxide, and nitrous oxide. Neutron-activation-analysis techniques were used to determine Li^6 and Li^6-to-Li^7 isotope ratios, metallic oxide and metallic film thickness, and particle-size distributions. Neutron-flux monitoring and the use of a radioactive tracer in the measurement of the surface area of uranium dioxide powders are discussed. Alpha, gamma, and neutron sources from Am^{241} were prepared for use in various analytical applications. The nature of the materials for and after use in the GCR and in the molten-salt and thorium oxide slurry test loops was studied, and a specific comparison in one such study was made by means of electron micrographs. The presence of bacteria in a tube that contained corrosion-inhibiting potassium dichromate solution located adjacent to the Homogeneous Reactor was discovered. A new isomer of yttrium was identified, and the gamma radiations of Pm^{148} and of Sb^{124} were studied. Eta values for U^{233}, U^{235}, and Pu^{239} were measured. New solvent-extraction methods in which amines and organophosphorus compounds are used have been developed. The Raw Materials Laboratory studied the reaction of ceric sulfate with tartaric acid and found that, under the conditions of the test, 0.133 mmole of tartaric acid was reacted per milliequivalent of ceric sulfate. Gas chromatographic methods were developed for the determination of impurities in helium, which is to be used as a coolant in the GCR. Principal determinations are for nitrogen, oxygen, argon, hydrogen, carbon monoxide, carbon dioxide, methane, and water vapor. The fluorination procedure with potassium tetrafluorobromide was extended to the direct determination of total oxygen in reactor-grade uranium dioxide. The relative standard deviation based on duplicate analyses of 18 samples is 0.4%. The determination of carbon in uranium dioxide was also investigated to establish orders of precision and accuracy. The Leco automatic sulfur analyzer was applied to various metals and to beryllium oxide. The procedure for the dissolution of graphite in perchloric acid was improved. A spectrophotometric method for yttrium by use of pyrocatechol violet was devised. The extraction characteristics of antimony, arsenic, and zinc with tri-n-octylphosphine oxide were determined. A new extraction reagent, 1-phenyl-3-isohexyenyl-1-phospha-3-cyclopentene-p-oxide was evaluated. Infrared spectral studies of organophosphorus compounds were continued. Complexometric titration methods using disodium dihydrogen ethylenediaminetetraacetate were adapted for the determination of zinc, magnesium, and thorium in fluoride salts. Extraction procedures were developed for concentrating titanium, nickel, chromium, and iron for spectrochemical analysis. A procedure for dissolving niobium–rare-earth-element alloys was developed that does not require the use of hydrofluoric acid. The sensitivity of the determination of cesium by flame photometry was greatly enhanced in a 100- to 200-ppm solution of potassium as potassium chloride in methanol. The electronic equipment for the determination of oxygen in metals has been installed on the Paschen spectrograph at the 60° slit position. Studies were continued on the improvement or development of methods for the analysis of solutions of uranyl sulfate, thorium oxide, mixtures of thorium oxide with uranium oxide and other metallic oxides, slurries of thorium oxide–uranium oxide, and a number of other materials. In the analysis of simulated Homogeneous Reactor fuel solutions of uranyl sulfate, high-frequency titrimetry was used for the determination of sulfate and free acid; a spectrophotometric method was developed for microgram or milligram quantities of osmium. Methods developed or adapted for the analysis of thorium oxide alone or of mixtures of it with other oxides included flame photometric methods for palladium and iron; a derivative polarographic method for molybdenum in a nitrilotriacetic acid medium; a spectrophotometric method for uranium; and three procedures (volumetric, controlled-potential coulometric, direct coulometric oxidation) for establishing the uranium(IV)-to-uranium(VI) ratio. Other methods studied included separation of fluoride from nitrate- or sulfate-containing solutions by pyrolysis; determination of microgram quantities of cobalt in aluminum by spectrophotometry; application of potentiometric titrimetry and flame photometry to the determination of rare-earth elements; simultaneous determination of two or more rare-earth elements; and direct titration of thorium with disodium dihydrogen ethylenediaminetetraacetate by means of xylenol orange as the indicator. SERVICE ANALYSES. The Raw Materials Laboratory and the Miscellaneous Analyses Laboratory analyzed 10,900 samples, most of which were derived from solvent-extraction studies. The Counting Laboratory processed 3150 samples. The Special Analyses Laboratory determined the uranium-to-oxygen ratio and nitrogen in compacts of uranium dioxide. The Radioisotopes-Radiochemistry Laboratory developed a method for the determination of Pm^{147}. They have also adopted some new techniques in the determination of Tc^{99}. The Process Development Analytical Laboratory has developed a method for determining low concentrations of thorium in the presence of sulfuric acid and stainless steel and of aqua regia and stainless steel. The coulometric determination of uranium and copper in a single aliquot has been extended to include the determination of nickel. Graphite rods impregnated with fused fluoride salts were analyzed in order to determine the depth of penetration of salts. (For preceding period see ORNL-2662.) (auth)

9456 SCS-M-28

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF COPPER IN URANIC MATERIALS. Mar. 20, 1953. 9p.

A method for the determination of copper in uranic materials is presented. The copper is separated at pH 2.0 to 2.5 by shaking with a chloroform solution of dithizone. After destruction of the organic extract the copper is determined absorptiometrically either with ammonia or diethyldithiocarbamate. The method is applicable only when the concentration of the copper does not exceed 0.5%. (auth)

9457 SCS-M-51

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF IRON AND MOLYBDENUM IN CRUDE URANIUM PEROXIDE. June 12, 1955. 6p.

A method for determining Fe and Mo in crude $UO_4 \cdot 2H_2O$ is given. The crude $UO_4 \cdot 2H_2O$ is dissolved in HCl and the free acid content of the solution adjusted to 4.5%. Fe and Mo are extracted from the HCl solution of the sample with cupferron and chloroform. These elements are determined spectrophotometrically, using thioglycolic acid, after evaporation of the chloroform and wet oxidation of the residual organic matter. (auth)

9458 SCS-M-57B
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF CHROMIUM IN CALCIUM FLUORIDE MOULD LINING. Mar. 13, 1951. 4p.

A method for the determination of chromium in calcium fluoride mold linings is presented. The calcium fluoride material is fused with fusion mixture in a platinum dish, leached with water, the solution filtered and neutralized with nitric acid. Boric acid is added to complex the fluoride and the chromium is oxidized by boiling with potassium bromate solution, the excess bromate being decomposed by boiling with sodium chloride. The solution is cooled, diluted, and diphenyl carbazide is added. The chromium is determined spectrophotometrically. (auth)

9459 SCS-M-232A
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF MOLYBDENUM AND TUNGSTEN IN HYDROLYSED URANIUM HETRAFLUORIDE [HEXAFLUORIDE]. July 30, 1953. 7p.

Both Mo and W are determined spectrophotometrically as dithiol complexes after the distillation and hydrolysis of UF_6. The interference of Cu in the Mo determination is prevented by ether extraction of Mo from 6.5 N HCl after the removal of fluoride by H_2SO_4. H_3PO_4 is added during the procedure to keep the W in solution. The acidity is adjusted to 4 to 5 M HCl. (C.J.G.)

9460 SCS-R-5
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF CHROMIUM IN URANOUS FLUORIDE. A. B. Crowther and S. M. Dykes. Mar. 31, 1949. 5p.

Chromium can be determined in UF_4 by treating the sample with ammonia and hydrogen peroxide and removing fluorides by volatilization as ammonium fluoride under controlled heating. The solution is evaporated to dryness, taken up in nitric acid, evaporated to dryness, and the residue taken up in water. The chromium is determined with diphenyl carbazide after oxidation with ammonium persulfate and silver nitrate. (C.J.G.)

9461 SCS-R-7
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF CHROMIUM IN URANIUM. A. B. Crowther, F. J. Armson, and S. M. Dykes. 1948. 5p.

Modifications are proposed for the method of chromium determination in uranium in which the chromium is precipitated by diphenyl carbazide and a colorimetric analysis is performed in the presence of sulfuric acid. Color development in a more dilute solution with a corresponding adjustment of acidity is proposed to lessen the tendency for precipitation to occur very shortly after addition of the diphenyl carbazide. (C.J.G.)

9462 SCS-R-9
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF LEAD IN CALCIUM FLUORIDE. A. B. Crowther, F. Warburton, and D. J. Grimshaw. Jan. 20, 1949. 8p.

A method for determining lead in calcium fluoride by extraction with dithizone in presence of ammonium citrate and potassium cyanide is given. Comparable amounts of bismuth and thallium extracted with the lead may be removed by shaking with a solution mixture of ammonia and cyanide, and a dilute cyanide solution, respectively. Solution of the material is achieved by treatment with a solution of boric acid in perchloric acid. (auth)

9463 SCS-R-22
Gt. Brit. Springfields Works, Springfields, Lancs, England.
SPECTROGRAPHIC DETERMINATION OF THULIUM. J. Golden. Jan. 25, 1949. 6p.

A study of the spectrographic determination of Tm revealed the lines 3172.8 and 3717.8 A to be the most free from interference. Line comparisons with iron were studied. (C.J.G.)

9464 SCS-R-45
Gt. Brit. Springfields Works, Springfields, Lancs, England.
ABSORPTIOMETRIC DETERMINATION OF NICKEL IN URANIUM. A. B. Crowther and H. T. Neville. Feb. 23, 1949. 13p. (SCS-R-46).

A method for the separation and determination of nickel in uranium by extraction of its chloroform soluble dimethyl glyoxime complex from ammoniacal citrate solution is presented. The nickel is obtained in aqueous solution by shaking the chloroform extract with dilute hydrochloric acid. This procedure also serves to separate the nickel from other elements forming complexes with dimethyl glyoxime, particularly iron, copper, and cobalt. Salt effects, the use of hypoiodite and hypobromite as oxidants, and the choice of filters in the spectrophotometers were investigated. (auth)

9465 SCS-R-53
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC ANALYSIS OF URANIUM TETRAFLUORIDE USING THE CARRIER DISTILLATION TECHNIQUE WITH SPECIAL REFERENCE TO THE DETERMINATION OF CHROMIUM. Preliminary Report. F. J. Woodman, A. B. Timms, and W. D. Smith. Sept. 12, 1949. 8p.

A method is proposed for the analysis of UF_4 by converting to a dense form of U_3O_8 by the addition of $(NH_4)_2CO_3$ and H_2O_2 and heating. The subsequent form of U_3O_8 is suitable for analysis by the carrier distillation method. The spectrographic determination of fifteen elements including chromium in UF_4 is reported. (C.J.G.)

9466 SCS-R-54
Gt. Brit. Springfields Works, Springfields, Lancs, England.
OBSERVATIONS ON SPECTROMETRIC EXPERIENCE IN THE ROUTINE ANALYSIS OF URANIUM BASE MATERIALS BY THE CARRIER DISTILLATION METHOD. R. A. Day. May 16, 1949. 10p.

Problems encountered in reading plates prepared by the carrier distillation method in the spectrographic analysis of uranium-base materials are discussed. A table of the wavelengths of various elements which can be analyzed by the method is contained. (C.J.G.)

9467 SCS-R-55
Gt. Brit. Springfields Works, Springfields, Lancs, England.
SPECTROGRAPHIC DETERMINATION OF URANIUM BY THE IRON FLUX METHOD. G. A. Palmer. May 6, 1948. 9p.

The iron flux method is shown to be suitable for the spectrographic determination of U in uranic materials. It is recommended that the U content be converted to the U_3O_8 form. (C.J.G.)

9468 SCS-R-63
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE ESTIMATION OF VANADIUM IN AQUEOUS AND DIBUTYLCARBITOL SOLUTIONS OF URANIUM. A. E. Sawyer and A. Cooper. Sept. 8, 1949. 5p.

Methods were developed for the determination of vanadium in aqueous and dibutylcarbitol solutions of uranium. Vanadium was extracted as the cupferride with chloroform and subsequently converted to pervanadic acid with hydrogen peroxide. The extractions of the yellow solutions so produced are compared by means of a Spekker absorptiometer. Dibutylcarbitol solutions are extracted with water from which soluble dibutylcarbitol is removed by evaporation with sulfuric acid. The vanadium in aqueous solution is again estimated as pervanadic acid. The method is applicable only to the determination of vanadium in solutions free from those elements which are extractable as chloroform soluble cupferron complexes at pH 1.5, and which also produce colored solutions upon the addition of hydrogen peroxide. (auth)

9469 SCS-R-87
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE ESTIMATION OF MICROGRAM QUANTITIES OF MAGNESIUM IN URANIUM METAL. C. D. Lafferty, F. H. Bolton, H. Mason, and J. A. Ryan. Mar. 24, 1950. 7p.

A method for the determination of Mg in U was devised. Uranium and other metals are precipitated with ammonium hydroxide at pH 7.0 to 7.5, and magnesium is determined colorimetrically in the supernatant liquor after centrifuging. (auth)

9470 SCS-R-90
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF MOLYBDENUM IN URANIUM METAL USING DITHIOL. C. D. Lafferty and F. M. Bolton. July 3, 1951. 10p.

A method for the determination of molybdenum in uranium metal is given. Using toluene 3,4-dithiol (1-methyl 3.4-mercapto-benzene) as complexing agent, molybdenum is extracted at controlled acidity from a solution of uranyl sulfate with carbon tetrachloride. The green colored solution so obtained is evaluated spectrophotometrically. (auth)

9471 SCS-R-94
Gt. Brit. Springfields Works, Springfields, Lancs, England.
ABSORPTIOMETRIC DETERMINATION OF COBALT IN CRUDE URANIUM PEROXIDE, PRECIPITATION LIQUORS AND MOTHER LIQUORS USING NITROSO-R SALT. C. J. Riley and R. M. Lees. Feb. 5, 1951. 12p.

A method for the spectrophotometric determination of cobalt in crude uranium peroxide, precipitation liquors, and other liquors was developed. Cobalt is extracted with chloroform as the xanthate complex, and converted to a reddish-colored complex with Nitroso-R salt. It was found that cobalt could be determined in the presence of uranium but, due to the amount of iron present, a separation was usually necessary. (auth)

9472 SCS-R-128
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF CADMIUM IN MISCELLANEOUS NON-URANIC MATERIALS. J. E Dunabin, A. P. Seyfang, and A. M. Deane. May 9, 1950. 17p.

A method for determining traces of cadmium in non-uranic materials is described. A dithiozone extract of cadmium is passed through activated alumina which is then spectrographed. The cadmium content is found by measurement of the appropriate spectral line. (J.R.D.)

9473 SCS-R-150
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF THORIUM IN IRON FLUX CONCENTRATES. R. Franklin and L. C. Middlefell. May 19, 1950. 7p.

A method of spectrographic determination of thorium in iron flux concentrates is presented in which the thorium 4086.5 A line is compared to the iron 4086.0 and 4088.6 A lines. (C.J.G.)

9474 SCS-R-158
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN HIGH PURITY NICKEL POWDER USING NICKEL AS INTERNAL STANDARD. S. Housley, M. M. Diggle, and G. A. Palmer. July 19, 1950. 18p.

A method for the spectrographic determination of impurities in nickel powder using nickel as an internal standard is given. Methods of purifying nickel, sample preparation, and optimum spectrographic conditions are discussed. (C.J.G.)

9475 SCS-R-162
Gt. Brit. Springfields Works, Springfields, Lancs, England.
A PRELIMINARY INVESTIGATION OF THE CHROMATOGRAPHIC SEPARATION OF ORGAN-METALLIC COMPLEXES ON COLUMNS OF ACTIVATED CELLULOSE PULP. D. Bevan, R. E. Cockaday, and H. Mason. May 1, 1952. 15p.

Preliminary investigations of metallic complex separation by chromatography are presented. Complexing agents such as dithiozone, cupferron, and sodium diethyldithiocarbamate are considered using columns of activated cellulose pulp. It was found that efficiency of absorption and separation of the complexes depends on the mode of activation and on the pH of aqueous pulp extracts. Experimental procedures are described and data are tabulated. (J.R.D.)

9476 SCS-R-214
Gt. Brit. Springfields Works, Springfields, Lancs, England.
A DETERMINATION OF SMALL TRACES OF CHLORIDE IN URANIUM METAL. E. L. Applegate, R. W. Cripps, and W. J. Pells. Jan. 31, 1952. 7p.

A method for determination of trace chloride in massive uranium metal is described. The method is numbered Springfields Method 87 A. (J.R.D.)

9477 SCS-R-217
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE EXTRACTION AND ANALYSIS OF GASES CONTAINED IN URANIUM CARTRIDGES. F. Jones, J. G. Griffith, and J. D. H. Hughes. Jan. 1, 1952. 22p.

A method for the extraction and analysis of less than 1 cc of gas enclosed between a uranium rod and its container is described. A method of determining the annular free space between them was developed. The gas is extracted by drilling under vacuum, is transferred by means of a Topler pump, and its volume is measured in a calibrated tube. Analysis of the gas is conducted with the aid of a micro-gas burette. Absorption of oxygen, carbon dioxide, carbon monoxide, and hydrogen is carried out by means of solid absorbents. Nitrogen is frozen out in silica gel at −185°C and the residual helium is determined by difference. Analysis of any one constituent is accurate to ±1.0% of the sample, and the apparatus is designed for samples of 0.2 to 1.0 cc. (auth)

9478 SCS-R-229
Gt. Brit. Springfields Works, Springfields, Lancs, England.
EXAMINATION OF THE TECHNIQUE OF SPECTRO-

GRAPHIC ANALYSIS OF SOLUTIONS USING A POROUS CUP ELECTRODE. A. P. Seyfang and D. Money. Sept. 28, 1951. 17p.

Spectrographic analysis of solutions using a porous cup electrode was investigated. Characteristics and performance of the method were examined. The limits of detection of some elements in pure and salt solutions were determined. Problems encountered in reproducibility tests are discussed. (auth)

9479 SCS-R-260

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

DETERMINATION OF GOLD, PLATINUM AND PALLADIUM IN BELGIAN CONGO ORES. A. B. Crowther, et al. Jan. 31, 1955. 45p. (ARDC/P-85).

A survey of analytical methods for determination of gold, platinum, and palladium in uranium ore is presented. A fire assay method to obtain a silver load in which the other elements are determined appears feasible. (J.R.D.)

9480 SCS-R-329

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF TRACE ELEMENTS IN METALLIC SODIUM AND SODIUM–POTASSIUM ALLOY BY THE POROUS CUP TECHNIQUE. G. I. Goodfellow, A. L. Wilson, T. H. Boyd, L. Lloyd, and P. A. Serin. 1959. Date of MS. Aug. 31, 1954. 18p. (ARDC/P-34).

A method for the determination of trace amounts of 15 elements in metallic sodium and sodium-potassium alloy (22.7% Na–77.3% K) was developed. The porous cup method of excitation is used, with palladium as internal standard. The spectra are recorded by means of a spectrograph. Microphotometry and a plate calibration technique are used for the evaluation of the spectrograms so obtained. Detection limits range from 2 to 15 ppm in the alkali metal or alloy. (auth)

9481 SCS-R-378

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF FREE ACIDITY IN SOLUTIONS CONTAINING URANYL AND OTHER HYDROLYSABLE IONS. J. A. Ryan, J. R. Sanderson, and D. Winsor. May 12, 1955. 36p. (ARDC/P-89).

A method for the determination of free acid in solutions containing uranyl and other hydrostable ions is given. The method is based on the complexing of uranium as the oxalate with the oxalate solution being cooled to 0°C prior to potentiometric titration to a predetermined pH. The end point was found to be independent of uranium concentration and occurs at pH 7.0. The Gran mathematical treatment of the pH/vol relation of the titrant curve is shown to be applicable over a wide range of uranium concentration in the oxalate/uranium/nitric acid system. (C.J.G.)

9482 SCS-R-381

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF ALKALI METALS IN POTASSIUM NIOBIUM FLUORIDE. J. R. Sanderson, R. Dickinson, and T. Mason. June 18, 1955. 9p. (ARDC/P-124).

A method for the determination of alkali metals in potassium niobium fluoride which depends on the use of both anion and cation exchange resins was developed. The alkal metals are absorbed on cation exchangers, the niobium passing through the effluent. Acid elution removes the alkali metals from the column, the eluate is evaporated, and the salt is dissolved in water. The aqueous salt solution is passed through an anion exchanger, and the resulting effluent is titrated with a standard acid to determine the per cent of alkali metals. (C.J.G.)

9483 USNRDL-TR-401

Naval Radiological Defense Lab., San Francisco.

THE DETERMINATION OF COBALT IN SEAWATER. H. V. Weiss and J. A. Reed. Feb. 10, 1960. 9p.

Cobalt was isolated from seawater by cocrystallization with α-nitroso-β-naphthol. Quantitative determination by a nitroso-R-salt method for each of two seawater samples, 50 and 100 liters in volume, indicated the cobalt content to be 0.038 micrograms/liter, after radiometric correction for losses incurred in the isolation process. (auth)

9484 WAPD-BT-16(p.147-50)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

PRE-INTEGRATED GAS THERMAL CONDUCTOMETRY. R. H. Robinson and D. B. Conklin. 4p.

The new system for integrating gas flow trains to be measured by thermal conductometric response is reported. Typical applications in instruments to measure hydrogen and to separate and specifically integrate oxygen and nitrogen are described. Other possible applications of the new system are discussed. (auth)

9485 WAPD-BT-16(p.151-5)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

A PRE-INTEGRATING DISSOLVED HYDROGEN ANALYZER. R. H. Robinson and D. B. Conklin. 5p.

An instrument to measure concentrations of hydrogen dissolved in water in the 1 to 100 cc/l range is described. Hydrogen is extracted from water with air in a closed flow system which automatically integrates the thermal conductometric response in three minutes. Several months of use have proven that operation of the instrument is simple, and stability and reproducibility of determinations are excellent. (auth)

9486 WAPD-CTA(GLA)-537

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE DETERMINATION OF URANIUM IN HIGH PURITY URANIUM OXIDES. G. W. Goward and V. R. Wiederkehr. Feb. 21, 1958. 7p. Contract AT-11-1-GEN-14. OTS.

A method for determination of uranium in high-purity uranium oxides is presented. Any impurity interferes which can be reduced in a Jones reductor, is not oxidized in the aeration step, and is capable of being oxidized by standard dichromate. (J.R.D.)

9487 WAPD-CTA(GLA)-538

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE DETERMINATION OF TETRAVALENT URANIUM IN HIGH PURITY URANIUM OXIDE. G. W. Goward and V. R. Wiederkehr. Feb. 21, 1958. 5p. Contract AT-11-1-GEN-14. OTS.

A method for determination of U^{4+} in high-purity uranium oxides is described. Any impurity which is capable of being oxidized by standard dichromate interferes. (J.R.D.)

9488 WAPD-CTA(GLA)-553

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE DETERMINATION OF URANIUM IN HIGH PURITY ENRICHED URANIUM METAL PELLETS. G. W. Goward, T. M. Reinhold, and V. R. Wiederkehr. Mar. 5, 1958. 8p. Contract AT-11-1-GEN-14. OTS.

Procedure and calculation methods are given, and it is

noted that any reducible impurity capable of reoxidation by standard dichromate solution interferes. (J.R.D.)

9489 WSL-R-35

Gt. Brit. Windscale Works, Sellafield, Cumb., England. THE SPECTROGRAPHIC ANALYSIS OF PLUTONIUM USING THE CARRIER DISTILLATION PRINCIPLE WITH SPECIAL REFERENCE TO THE ESTIMATION OF BORON. H. E. R. Hartley and R. Orrell. June 19, 1952. 11p.

The application of the carrier distillation principle to plutonium analysis was investigated. Arc excitation conditions with a 20-cm source-slit distance were employed for the plutonium charge which contained three times its weight of uranium as a buffer. Gallium oxide was found superior to silver chloride as carrier. Boron and other elements can be determined in plutonium nitrate or chloride solutions by the above method. (C.J.G.)

9490 WSL-R-36

Gt. Brit. Windscale Works, Sellafield, Cumb., England. THE DETERMINATION OF HEAVY METAL FLUORIDES BY PYROHYDROLYSIS. G. A. Welch and N. Parker. June 17, 1952. 10p.

A method of determining thorium, uranium, and plutonium fluorides by pyrohydrolysis at 1000°C in a current of steam is presented. The determination of the fluorine content by titration with standard alkali can be accurately performed. (C.J.G.)

9491 WSL-R-47

Gt. Brit. Windscale Works, Sellafield, Cumb., England. THE ABSORPTIOMETRIC ESTIMATION OF T.T.A. AS THE COPPER CHELATE. M. F. Sheppard and E. F. Kemp. Oct. 23, 1952. 13p.

A method was developed for estimating thenoyltrifluoroacetone (TTA) in plant solutions. The method depends upon formation of a copper chelate which is extracted into benzene. The amount of chelate present is determined by a spectrophotometric measurement of the copper peak. The method can be applied to plant solutions containing TTA and inorganic ions in both aqueous and benzene phases. (auth)

9492 CEA-tr-A-666

SIMPLIFICATION DE LA MÉTHODE DU FLOTTEUR POUR LA DÉTERMINATION DE LA TENEUR EN D_2O DE L'EAU ORDINAIRE. (Simplification of the Float Method for Determination of the D_2O Content of Ordinary Water). P. Baertschi and M. Thurkauf. Translated into French from Helv. Chim. Acta 42, 281-93(1959). 25p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 16821.

9493 IGRL-T/C-110

DETERMINATION OF MOISTURE CONTENT IN GASES. M. Singliar. Translated by D. M. Rich from Chem. prumysl 6, 426-7(1956). 5p.

A colorimetric method for determination of small quantities of moisture in gases is described. Moisture concentrations of 5×10^{-6} % by volume can be determined using this method. (J.R.D.)

9494

URINARY URANIUM LEVELS IN NON-EXPOSED INDIVIDUALS. George A. Welford, Robert S. Morse, and John S. Alercio (U. S. Atomic Energy Commission, New York). Am. Ind. Hyg. Assoc. J. 21, 68-70(1960) Feb.

Results are reported from fluorimetric determinations of uranium in urine from 26 persons with no history of uranium exposure. The analytical procedure is described. A range of urinary uranium levels of 0.030 to 0.300 microgram per liter of urine was found in samples collected weekly over a ten-week period. (C.H.)

9495

ELECTROANALYSIS BY MEANS OF ISOTOPE DILUTION. I. MICROCOULOMETER FOR RADIOACTIVE SILVER AND THE DETERMINATION OF SILVER. J. Růžička (Karls-universität, Prague). Collection Czechoslov. Chem. Communs. 25, 199-205(1960) Jan. (In German)

The measurement possibility of the electric charge from the activity of a precipitating radioisotope for electroanalysis by means of isotopic dilution was proved. With application of scintillation measuring techniques and the Ag^{110} isotope with the specific activity of 10 mc/g, the measurement range was 0.05 to 0.80 coulomb in a current density of 0.03 to 0.30 mamp/cm^2. On the basis of these results, the coulometric method for the determination of milligram and submilligram quantities was perfected with the help of electrolysis by means of isotopic dilution. For silver determination a new radiochemical method was worked out in which the degree of dilution of the radioactive isotope by the material to be analyzed was determined by comparison of the activities in the standard and the sample solutions. The average relative error was ±2%. (tr-auth)

9496

DIRECT DETERMINATION OF THE CONCENTRATION OF URANYL NITRATE IN TRIBUTYL PHOSPHATE. V. Shraer (Inst. for Nuclear Research, Czechoslovak Academy of Sciences, Prague). Collection Czechoslov. Chem. Communs. 25, 304-6(1960) Jan. (In Russian)

A direct method for the determination of uranyl nitrate in tributyl phosphate is described. The method depends on the precipitation of the uranyl nitrate with ammonia. (tr-auth)

9497

COLORIMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF COBALT WITH p-NITROPHENYLHYDRAZONE OF DIACETYLMONOXIME. Hsi-hua Hu, Yu-ching Leu, Hsueh-tze Soong, and Ping-tsing Chu. Hua Hsüeh Hsüeh Pao 24, 255-7(1958). (In Chinese)

The formation of a violet or pink colored complex of Co^{3+} with p-nitrophenylhydrazone of diacetylmonoxime in the presence of ammonium hydroxide was utilized in the colorimetric determination of microgram quantities of cobalt. Ammonium acetate, together with ethyl alcohol, was used to destroy the violet color developed by the interaction between ammonium hydroxide and the reagent. Beer's law was obeyed over the range 0 to 5 γ cobalt per ml solution. The method devised is rapid and reproducible. (Sci. Abstr. China; Chem. and Chem. Technol. No. 1, 1958, abstract No. 51).

9498

AN EASY WAY OF CALCULATING THE COMPOSITION OF A TWO-COMPONENT SYSTEM FROM TWO-CHANNEL SPECTROMETRY. A. Bill, K. J. Öbrink, and H. R. Ulfendahl (Univ. of Uppsala). Intern. J. Appl. Radiation and Isotopes 7, 152-4(1959) Dec.

Equations are derived for calculating the composition of a two-component system from two-channel spectrometry. A simple electric analog is explained and used for computing the constituents. (B.O.G.)

9499

THE ISOTOPE DILUTION METHOD AND ITS APPLICATION TO ANALYSIS OF INORGANIC SUBSTANCES. I. P. Alimarin and G. N. Bilimovitch (Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR).

Intern. J. Appl. Radiation and Isotopes 7, 169-81(1960) Jan. (In English)

General principles of isotope dilution with radioactive and stable tracers are considered. The importance of the purity of recovered substances and the dependence of accuracy on various factors are discussed. Practical application of the isotope dilution method to analysis of inorganic substances is briefly discussed. Determinations of antimony, yttrium, tantalum, and niobium are given as illustrations. (auth)

9500

LITHIUM ALUMINUM TRITIDE IN ACTIVE HYDROGEN ANALYSIS. D. J. Chleck, F. J. Brousaides, W. Sullivan, and C. A. Zeigler (Tracerlab, Inc., Waltham, Mass.). Intern. J. Appl. Radiation and Isotopes 7, 182-5(1960) Jan. (In English)

The feasibility of radiochemical assaying for active hydrogen using lithium aluminum tritide (LAT) has been demonstrated. The sensitivity of the method allows very small quantities of material to be analyzed. The procedure is readily adaptable for the routine quantitative analysis of compounds containing active hydrogen. (auth)

9501

POLAROGRAPHIC DETERMINATION OF HEXAVALENT URANIUM IN URANIUM DIOXIDE. USE OF THE STRONG PHOSPHORIC ACID FOR THE DISSOLUTION OF SAMPLE. K. Motojima and A. Hoshino (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 1-5 (1960). (In Japanese)

An analytical method for the polarographic determination of uranium(VI) in uranium dioxide samples is proposed. The sample is dissolved in strong phosphoric acid by heating at 200°C. After cooling, the solution is diluted with water and subjected to polarography. The maximum wave of uranium(VI) is suppressed by the presence of uranium(IV) but does not interfere with the determination. The wave height of uranium(VI) is affected by the concentration of the strong phosphoric acid, dissolved oxygen, and temperature. Precipitation of uranium(IV) phosphate depends on the concentration of the strong phosphoric acid in final solution. By this method, 0.025% of uranium(VI) in uranium dioxide can be determined. (auth)

9502

PROCEEDINGS OF THE PACIFIC SOUTHWEST ASSOCIATION OF CHEMISTRY TEACHERS. SEPARATING Nd FROM Pr. A LABORATORY EXPERIMENT IN ION EXCHANGE CHROMATOGRAPHY. George B. Kauffman and Jerome S. Blank (Fresno State Coll., Calif.). J. Chem. Educ. 37, 156-8(1960) Mar.

A laboratory experiment in ion exchange chromatography is presented for the separation of neodymium from praseodymium. A chelating agent, ethylenediaminetetraacetic acid (EDTA), is used in the separation of the lanthanides. The procedure is presented and an explanation of how the reactions occur in the process is included. (B.O.G.)

9503

U ENRICHMENT CAN BE CHECKED BY GAMMA-RAY SPECTROMETRY. L. A. Sarkes and N. L. MacKinnon (M & C Nuclear, Inc., Attleboro, Mass.). Nucleonics 18, No. 3, 107(1960) Mar.

The gamma spectrum of a uranium sample on an oscilloscope screen provides a fast, visual means of determining whether the sample is natural or enriched. Typical experimental curves are plotted for the gamma spectra of U^{235} and natural uranium, from which it is easy to distinguish the difference in the samples. Two intense U^{235} peaks appear at 92 and 184 kev, and a third peak of lesser intensity at 143 kev. The one distinct photopeak (90 kev) associated with the natural uranium spectrum is due to Th^{234} and U^{235} (B.O.G.)

9504

VOLUMETRIC DETERMINATION OF URANIUM BY REDUCTION WITH STANNOUS CHLORIDE. Sheau-shia Kao, Chia-shu Liu, Wan-hsien Wu, and An-mo Lee. Pei Ching Ta Hsüeh Hsüeh Pao—Tza Jan K'o Hsüeh 4, 90-3(1958). (In Chinese)

The catalytic effect of iron salts and phosphoric acid on the reduction of U(VI) to U(IV) with stannous chloride was investigated. It was found that U(VI) may be quantitatively reduced to U(IV) in 4 to 6M hydrochloric acid solution containing not less than 0.5M phosphoric acid. The addition of iron catalyst was found not necessary, thus avoiding the correction for the volume of dichromate solution consumed by the catalyst. The catalytic nature of phosphoric acid was studied polarographically. It was found that phosphoric acid stabilizes U(IV) with respect to U(V) due to complex formation, so that in a solution containing more than 0.5M phosphoric acid, U(VI) can be reduced to U(IV) quantitatively. (Sci. Abstr. China; Chem. and Chem. Technol. No. 1, 1958, abstract No. 52).

9505

DETERMINATION OF RADIOACTIVE STRONTIUM IN RESERVOIR WATERS. L. K. Ponomareva and V. L. Zolotavin. Radiokhimiya 1, 208-11(1959). (In Russian)

Sr is first concentrated by a carbonate precipitation in 5 liters of water. Ca is separated by a fuming HNO_3 precipitation. The total $Sr^{90} + Sr^{89}$ content is thus determined in two hours with a maximum error of ±10%. Sr^{90} alone is determined within a maximum error of ±10% by counting the Y^{90} daughter 24 hours later. As small as 5×10^{-11} curies/l of Sr^{90} can be determined by these methods, an order of magnitude lower than the maximum permissible concentration in water. (R.V.J.)

9506

RADIOMETRIC ANALYSIS OF TRITIATED ORGANIC COMPOUNDS BY MEANS OF VAPOR PHASE CHROMATOGRAPHY. F. Cacace and Inam-ul-Haq (Univ. of Rome). Science 131, 732-3(1960) Mar. 11.

An analytical method, involving the gas chromatographic separation and the quantitative measurement of tritiated volatile compounds, was studied. The method was successfully employed to detect traces of carrier-free tritiated substances. (auth)

9507

SPECTROPHOTOMETRIC DETERMINATION OF MOLYBDENUM IN STEEL WITH 3:3′:4′:5:7-PENTAHYDROXYFLAVANONE. Frank L. Chan and Ross W. Moshier (Wright Air Development Center, Wright-Patterson AFB, Ohio). Talanta 3, 272-6(1960) Jan.

Studies on the organic reagent 3:3′:4′:5:7-pentahydroxyflavanone (dihydroquercetin) have led to the development of a colorimetric method for molybdenum in steel. By an extraction process all interfering metals are removed except tungsten. The method is applicable to the determination of molybdenum in all substances which do not contain tungsten. Known methods of separating molybdenum from tungsten will permit its use when tungsten is present. (auth)

Radiation Chemistry

9508 AD-216667

Quantum, Inc., Wallingford, Conn.

THE FORMATION OF NEW POLYMERS USING IONIZING

RADIATION. Quarterly Technical Report No. 2 [for] December 12, 1958–March 12, 1959. R. F. Horan. 38p. Contract DA-44-009-Eng-3723.

Radiation polymerization was studied as a useful method of synthesis in the development of new plastic materials of high thermal stability and structural strength characteristics. A survey-type program was initiated to scan a host of potential copolymer materials which in themselves exhibit known high temperature properties and are theoretically capable of forming a highly cross-linked network for increased structural strength. A great many proposed polymer materials in the past have eluded development by conventional techniques. Many of these systems, however, exhibit a marked reactivity under the influence of the highly ionizing energy of gamma radiation. Radiation-induced polymerization involves only the pure starting compounds and should produce materials of intrinsically higher thermal characteristics and dielectric strength properties than conventional polymers. Eight of the thirty-five reactions reported to date have produced polymers of some promise. Melting points of these polymers are generally on the order of 300°C. Proposed structures for these products involve the highly stable P-N cyclic structure as in the triallycyanurate–phosphonitrillic chloride copolymer; phenyl-Sn-C- chains as in polymers formed with triallylcyanurate-diphenyldichlorostannane. (auth)

9509 AD-226148

Quantum, Inc., Wallingford, Conn.

THE FORMATION OF NEW POLYMERS USING IONIZING RADIATION. Quarterly Technical Report No. 1 [for] September 12, 1958–December 12, 1958. 11p. Contract DA-44-009-Eng-3723.

Although diisopropenyl acetylene can be made to polymerize quite easily, it appears that most of the additives acted as inhibitors for doses on the order of 10^6 r. Higher doses of 10^8 r did induce some solid polymer formation in most of the mixtures exposed; however, due to the small quantity of material used in the Van de Graaff irradiation experiments, it was not possible to determine much about their physical properties. In all cases, the solids formed appeared to be of a gummy consistency. It was noted that every exposure induced some visible color changes and that in every case, save one, a slight change in refractive index took place. In general, it may be said that diphenyl dichlorosilane, in mixtures of the experiments run to date, does not appear to be stable enough to permit any promising degree of polymerization. The sensitivity of halogen substituted materials to ionizing radiation was recognized. It was postulated that this could lead to useful copolymers. However, the general darkening in color with increased radiation exposure seems to indicate degradation rather than an overriding chainforming or crosslinking reaction in the mixture. In regard to solids or gelatinous compounds formed using methylol acrylamide, it will be interesting to analyze the infrared curves of this mixture to determine if polymerization occurred both through the vinyl group and through the hydroxy methyl group. (auth)

9510 BNL-1960

Brookhaven National Lab., Upton, N. Y.

RADIATION DAMAGE TO WATER. A. O. Allen. [1954?]. 14p. OTS.

Water may decompose under radiation to give hydrogen and oxygen gases and small amounts of hydrogen peroxide. The amount of decomposition depends critically on the nature of the radiation, the kind and amount of dissolved materials present, and the temperature. Destruction of dissolved material may proceed to a greater extent than that of the water itself. The basic theory of these effects is briefly outlined. Engineering problems resulting from radiation chemical effects in water are discussed for various cases in which ordinary or heavy water is used in reactors as moderator, coolant, or shielding material. (auth)

9511

RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS OF ORGANIC HALOGEN DERIVATIVES. II. MECHANISM OF THE RADIOLYSIS OF AN AQUEOUS CHLOROFORM SOLUTION. J. Teplý (Militärische Akademie "A. Zápotocký," Brno). Collection Czechoslov. Chem. Communs. 25, 24-30(1960) Jan. (In German)

The analysis of the reactions made possible by radiation in an aqueous chloroform solution was made. The reaction scheme derived was proved by orientation calculations of the yields. (tr-auth)

9512

THE OXIDATION OF IRRADIATED POLYETHYLENE. I. RADIO-OXIDATION. R. M. Black (British Insulated Callender's Cables Ltd., London) and A. Charlesby (Royal Military Coll. of Science, Shrivenham, Eng.). Intern. J. Appl. Radiation and Isotopes 7, 126-33(1959) Dec.

When polyethylene is subjected to high energy ionizing radiation—either electrons, γ- or x-rays, protons, or α-particles—a number of chemical changes are produced which result in changes in the physical properties. These changes include the formation of crosslinks, main chain fracture, and unsaturation. If irradiation is carried out in the presence of oxygen, further changes take place due to the interaction between the oxygen and the free radicals formed during the irradiation process. This radio-oxidation was studied by infrared and ultraviolet absorption measurements, by chemical analysis, and by the measurement of the dielectric loss angle. The oxidation process is discussed and some tentative mechanisms are proposed for the type of reaction involved. The effect of the addition of various types of conventional antioxidants to the system prior to irradiation was investigated. (auth)

9513

THE OXIDATION OF IRRADIATED POLYETHYLENE. II. THERMAL OXIDATION. R. M. Black (Insulated Callender's Cables Ltd., London) and A. Charlesby (Royal Military Coll. of Science, Shrivenham, Eng.). Intern. J. Appl. Radiation and Isotopes 7, 134-40(1959) Dec.

The oxidative changes which take place in irradiated polyethylene on exposure to air or oxygen at elevated temperatures were followed by infrared and ultraviolet spectrophotometry, by weight loss and oxygen absorption measurements and by estimation of the hydroperoxides produced. While the data presented are insufficient to enable a mechanism for the oxidation process to be proposed it is found that the radiation induced changes in the constitution of the polymer exert a significant effect on the subsequent rate of thermal oxidation. (auth)

9514

THE PREPARATION OF POTASSIUM-43 USING AN INTERRUPTED CYCLOTRON BEAM. N. A. Dyson and P. E. Francois (Medical Research Council, Hammersmith Hospital, London). Intern. J. Appl. Radiation and Isotopes 7, 150-2(1959) Dec.

A method for the preparation of K^{43} utilizing the reaction $Ar^{40}(\alpha,p)$ is presented. In this method Ar^{40} is contained at 2 to 3 atmospheres in a vessel and is bombarded by a 30-Mev beam of α particles from a cyclotron. The awkward collection method, washing the K^{43} off the vessel's sides, was solved by inserting in the bombardment vessel

a collection rod carrying a negative potential of 1 kv and using a shutter over the beam hole which equalized the bombardment and collection times. Approximately 75% of the total removable activity appears on the rod. The K^{43} is identified by its 22.4 hr half life and its γ-ray spectrum. (B.O.G.)

9515

THE RADIATION-INDUCED SYNTHESIS OF THE INSECTICIDE "GAMMEXANE." II. SYNTHESIS BY HIGH-ENERGY RADIATION. P. R. Hills, R. Roberts, and M. W. Spindler (Wantage Radiation Lab., Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 7, 217-24(1960) Jan. (In English)

A study of the preparation of 1:2:3:4:5:6-hexachlorocyclohexane by radiation from cobalt-60 has shown that the Gammexane content of the crude material is independent of dose rate, benzene concentration and duration of the chlorination process. Small increases in the Gammexane content can be effected by low temperature chlorination. When compared with the conventional photo-initiated reaction the radiation method exhibits a marginal improvement in Gammexane content but the efficiency of energy utilization is similar. (auth)

9516

PROPERTIES OF β-HEAT TREATED URANIUM ROD. STUDIES ON URANIUM FUEL ELEMENT, (5). K. Taketani (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 6-14(1960). (In Japanese)

Uranium rods fabricated by rolling at 300 and 600°C were heat treated at various temperatures and times. These rods were thermal cycled 1,000 times at room temperature to 550°C. The cycling growth coefficient $G_{tN} = (l - l_0) \times 10^6/l/N$ of various samples is given in tabular form. Microphotographs of 14 rod specimens before and after thermal cycling are contained. Specific gravity and Vickers hardness values of these specimens before and after thermal cycling are given as well as the dilatation curves obtained. (auth)

9517

ISOMERIC EFFECTS IN FRAGMENTATION BY BETA DECAY: MONOTRITIATED PROPANES AND TOULENES. S. Wexler, G. R. Anderson, and L. A. Singer (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 32, 417-27 (1960) Feb.

The spectra of positively charged fragments from beta decay of tritium in primary and secondary monotritated propane and in o-, m-, p-, and α-monotritiated toluene were determined by mass spectrometric techniques. Although the number of products from decomposition of each molecule is quite large, the mass patterns from the two propanes are fairly similar while the four mass spectra from the isomeric tritated toluenes are very nearly the same. These results suggest that the influence of the location of the radioactive atom in the molecule on the fragmentation following beta decay is often obscured by secondary processes, such as radiationless transitions, H-atom migration, and other rearrangements of the excited molecular ion before breakup. Significant differences exist within the two groups of mass spectra. Some of the differences in the propane patterns are consistent with the greater stability of the secondary propyl structure as compared to that of the primary isomer. Energetically plausible decomposition schemes for the tritiated propanes are proposed. The distributions of excitation energies made available to the daughter molecular ions $(C_3H_7He^3)^+$ in the beta transformation of H^3 to He^3 are estimated. (auth)

9518

HYDROGEN FORMATION IN THE RADIATION CHEMISTRY OF WATER. H. A. Mahlman (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 32, 601-3(1960) Feb.

The molecular hydrogen yields in concentrated aqueous sodium nitrate solutions by cobalt-60 gamma-ray irradiation were observed and correlated with the molecular hydrogen yields observed in dilute solutions. The $G(H_2)$ plotted as the cube root of the $NaNO_3$ activity exhibits a sharp break indicative of a change in the mechanism of formation. The predominant process, designated E_1, is readily affected by a scavenging solute. A process of lesser magnitude, designated E_2, is less susceptible to solute scavenging. The sharp break is interpreted as the cessation of the E_1 process. The $G(H_2)$ observed in the $NaNO_3$ solutions at 298°K is correlated with the $G(H_2)$ observed in ice at 77°K. It was observed that the hydrogen formed by the E_1 process may be eliminated by irradiation of aqueous nitrate solutions at 77°K. The $G(D_2)$ data observed in comparable $D_2O-NaNO_3$ solutions also exhibit the same mechanisms of formation. The isotope effect on the formation of D_2 in D_2O is in qualitative agreement with two initial distributions of the H atoms. (auth)

9519

α-PARTICLE RADIOLYSIS OF CARBON MONOXIDE. A. C. Stewart and H. J. Bowlden (Union Carbide Corp., Cleveland). J. Phys. Chem. 64, 212-16(1960) Feb.

Presented is a theoretical analysis of new and old experimental work on the α-radiolysis of carbon monoxide. Specific attention is given to the effects of adding nonreactive gases. A model is presented, and the resulting equations are fitted to the data by a least-squares technique. A value is obtained for the reaction cross section in pure CO. Evidence is presented to support the hypothesis that ionization plays a large role in the process. (auth)

9520

RADIOLYSIS OF n-PARAFFINS: MECHANISM OF FORMATION OF THE HEAVY PRODUCTS. C. D. Wagner (Shell Development Co., Emeryville, Calif.). J. Phys. Chem. 64, 231-7(1960) Feb.

n-Pentane in liquid phase was irradiated with high energy electrons and photons and the products analyzed. The The C_6-C_{10} iso-and n-paraffins are formed in the early stages by free radical recombination, involving methyl, ethyl, n-propyl, n-butyl, 1-pentyl, 2-pentyl, and 3-pentyl radicals. Relative steady-state concentrations of these radicals were determined from the product distribution. Absolute total free radical concentration at the dose rate used is of the order of 10^{-7} mole per liter, with mean lifetimes of slightly less than a millisecond at 25°. 1-Pentene and cis- and trans-2-pentenes are major products, formed by a reaction independent of temperature and of the presence of radical scavengers. Formation of cis-olefin had not previously been observed. The product pentenes react at nearly equal ratios by a mechanism as yet unknown. This reaction of the olefins is not important in the formation of heavy products below doses of the order of 3×10^7 rads, but becomes increasingly important above this level. All major products and nearly all minor ones evidently originate from simple bond-breaking processes. Isomerizations and complicated concerted processes are essentially absent. Alkyl free radical disproportionations, decompositions, and hydrogen abstraction reactions are absent. (auth)

9521

EFFECT OF IONIZING RADIATION UPON XANTHOSINE IN DILUTE AQUEOUS SOLUTION. G. Hems (Chester

Beatty Research Inst., London and Barnato-Joel Labs., Middlesex Hospital, London). Nature 185, 525-6(1960) Feb. 20.

Results are reported from a study of radiation effects on dilute aqueous solutions of xanthosine. (C.H.)

9522

EFFECT OF HIGH-ENERGY RADIATION ON MIXTURES OF VINYL OR RELATED POLYMERS WITH UNSATURATED COMPOUNDS. B. J. Lyons (British Insulated Callender's Cables, Ltd., London). Nature 185, 604-6 (1960) Feb. 27.

Results are reported from an investigation of the effects of diethyl maleate, dibutyl itaconate, and triallyl cyanurate on the enhancement of cross-linking in irradiated polymers in general and on polymers of the vinyl family in particular. Data are presented graphically. Reaction mechanisms involved are discussed. (C.H.)

9523

EFFECT OF ALPHA RADIATION ON THE VALENCE OF PLUTONIUM IN NITRIC ACID SOLUTIONS. P. I. Artyukhin, V. I. Medvedovskii, and A. D. Gel'man. Radiokhimiya 1, 131-5(1959). (In Russian)

It was found that the initial rate of reduction of Pu^{6+} in HNO_3 with alpha radiation increases with an increase in concentration of nitrate and decreases as $[H^+]$ increases. It is believed that reduction of Pu^{6+} in nitrate solutions is a result of hydrogen peroxide and nitrous acid formed as by-product of alpha radiation. (R.V.J.)

9524

EFFECT OF THE CONDITIONS OF IRRADIATION ON THE DISTRIBUTION OF RADIOACTIVE ATOMS IN THE MOLECULE OF TOLUENE LABELLED BY TRITIUM EXCHANGE. Bianca Aliprandi, Fulvio Cacace, and Luciana Cieri (Centro di studio per la chimica nucleare, Rome). Ricerca sci. 30, 90-6(1960) Jan. (In Italian)

Radioactive toluene was prepared by exchange with gaseous tritium, under various irradiation conditions. The distribution of the tracer in the labeled molecule as a function of the modalities of reaction and of the specific activity obtained was investigated. The possibility of modifying the percentage of tritium contained in each position of the ring within rather wide limits was emphasized. (auth)

9525

IMPROVEMENTS RELATING TO THE CURING OF PLASTICS. Arthur Charlesby, Trevor Thomas Greenwood, and Vernon Wycherley. (to T. I. (Group Services) Ltd.). British Patent 828,717. Feb. 24, 1960.

A radiation treatment for polyester resins is described. A curing is brought about by irradiation and catalysis in separate stages or by two separate irradiations. In an example, a condensation product of diethylene glycol and phthalic and maleic anhydrides mixed with 30 parts styrene per 100 parts condensation product was irradiated by a 2-Mev linear electron accelerator. After 3 megarads 11% toluene-soluble material was found and after an additional 7 megarads, only 5%. In another example, 2% butyl per acetate catalyst was added before irradiation and activated by heating after irradiation. Improved properties and forms are obtainable by these methods of curing. (T.R.H.)

Radiochemistry

9526 NAS-NS-3001

National Research Council. Committee on Nuclear Science.

THE RADIOCHEMISTRY OF CADMIUM. James R. DeVoe, Univ. of Michigan. Jan. 1960. 61p. OTS.

Its Nuclear Science Series.

This volume which deals with the radiochemistry of Cd is one of a series of monographs on radiochemistry of the elements. There is included a review of the nuclear and chemical features of particular interest to the radiochemist, a discussion of problems of dissolution of a sample and counting techniques, and finally, a collection of radiochemical procedures for the elements as found in the literature. (W.L.H.)

9527 NAS-NS-3002

National Research Council. Committee on Nuclear Science.

THE RADIOCHEMISTRY OF ARSENIC. Harold C. Beard, Florida State Univ. Jan. 1960. 31p. OTS.

Its Nuclear Science Series.

This volume which deals with the radiochemistry of As includes a review of the nuclear and chemical features of particular interest to the radiochemist, a discussion of problems of dissolution of a sample and counting techniques, and finally, a collection of radiochemical procedures for the elements as found in the literature. (auth)

9528 NAS-NS-3003

National Research Council. Committee on Nuclear Science.

THE RADIOCHEMISTRY OF FRANCIUM. Earl K. Hyde. Univ. of California. Lawrence Radiation Lab., Berkeley. Jan. 1960. 38p. OTS.

Its Nuclear Science Series.

This volume which deals with the radiochemistry of Fr is one of a series of monographs on radiochemistry of the elements. There is included a review of the nuclear and chemical features of particular interest to the radiochemist, a discussion of problems of dissolution of a sample and counting techniques, and finally, a collection of radiochemical procedures for the elements as found in the literature. (auth)

9529

THE PREPARATION OF S^{35}-AND/OR Cl^{36}-LABELLED SO_2Cl_2. A SIMPLE TECHNIQUE FOR THE QUANTITATIVE PREPARATION OF MICRO- AS WELL AS MACRO-QUANTITIES. G. A. Ovezali-Klaasen and J. Halberstadt (Isotope Lab., Philips-Duphar, Weesp, Netherlands). Intern. J. Appl. Radiation and Isotopes 7, 145-7(1959) Dec.

Radioactive sulphuryl chloride labeled with S^{35} and/or Cl^{36} can be prepared in every quantity and with every possible specific activity by mixing calculated quantities of radioactive $S^{35}O_2$ with a small excess of Cl_2 gas, or Cl_2^{36} gas with a small excess of SO_2. Mixing is done in a reaction vessel in which a small quantity of charcoal acts as a catalyst. The yields are practically 100 per cent. (auth)

9530

HOT-ATOM CHEMISTRY OF BROMINE ATOMS IN CRYSTALLINE POTASSIUM BROMATE. Garman Harbottle (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 82, 805-9(1960) Feb. 20.

The reactions of recoil bromine atoms in potassium bromate were further investigated. The retention (yield of bromate) was determined as a function of the bombardment time, flux of neutrons, conditions of dissolution and the particular isotope investigated. The yield of bromate from the isomeric transition process in Br^{80m}-labeled potassium bromate was measured as a function of the ambient temperature. The results of these experiments are compared with previous work and significant differences are found. (auth)

9531

ISOLATION OF MILLIGRAM QUANTITIES OF LONG-LIVED TECHNETIUM FROM NEUTRON IRRADIATED

MOLYBDENUM. G. E. Boyd, Q. V. Larson, and E. E. Motta (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 82, 809-15(1960) Feb. 20.

The method employed for the isolation of milligram quantities of long-lived Tc^{99} formed in molybdenum metal by prolonged neutron irradiation in the Oak Ridge graphite-natural uranium pile is described. The identity of the element isolated was established by measurements of its x ray and its optical emission spectra. Careful specific activity determinations using 4π beta counting techniques yielded a value of $2.15 \pm 0.05 \times 10^5$ years for the half-life of Tc^{99g}, while measurements of the absorption of its radiations in aluminum gave 0.29 ± 0.01 Mev as its maximum β-ray energy. Collateral observations on the wet volatility, solvent extraction, reduction by metals in acid and alkaline solutions and on the coprecipitation of tracer quantities of technetium were made. A convenient method for the preparation of high specific activity technetium tracer from cyclotron irradiated molybdenum metal targets is outlined. (auth)

9532

APPLICATION OF PHOSPHORIC ACID ESTERS TO THE ISOLATION OF CERTAIN trans-PLUTONIDES BY LIQUID-LIQUID EXTRACTION. D. F. Peppard, G. W. Mason, W. J. Driscoll, and S. McCarty (Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 12, 141-8(1959) Dec.

The use of $(GO)_2PO(OH)$ and $(GO)PO(OH)_2$ as extractants in a carrier solvent against an opposing aqueous mineral acid phase in effecting certain mutual separations in the actinide (III) series and lanthanide (III) series, including Y(III), was investigated. The separation of Cf (and E and Fm) from Cm (and Am) by use of a di-2-ethylhexyl phosphoric acid–HCl system and the separation of Cf (and E and Fm) from Y by use of a diphenyl phosphoric acid–HCl system were shown to be applicable to nuclear problems on a laboratory scale. It seems likely that these systems could be applied even more efficiently to large-scale operations. The separation of Bk(III) from Ce(III) by use of a di-2-ethylhexyl phosphoric acid–HCl system and the separation of Am(III) from Pm(III) by use of a mono-2-ethylhexyl phosphoric acid–HCl system were demonstrated. Other systems suitable for the latter separation are reported also. No system readily applicable to the separation of Am and Cm was developed. The depressant effect of an alcohol on the extractive properties of $(GO)PO(OH)_2$ is noted, and the corresponding depressant effect of $(GO)_3PO$ on the extractive properties of $(GO)PO(OH)_2$ is utilized in preventing interference by the latter ester in certain separations dependent upon the extractive actions of $(GO)_2PO(OH)$. (auth)

9533

EFFECT OF RADIOACTIVITY ON ADSORPTION PROPERTIES OF A PRECIPITATE. V. I. Spitsyn and V. V. Gromov. Radiokhimiya 1, 181-4(1959). (In Russian)

The effect of additions of radioactivities (S^{35} and Ra) on the adsorption properties of barium sulfate for methylene blue and acid orange was investigated. It was established that with increasing specific activity of S^{35}, the adsorption of methylene blue decreases, while that of acid orange increases. This behavior is reversed with the use of radium in the $BaSO_4$ precipitate. It is assumed that the beta activity imparts a positive charge to the surface of the $BaSO_4$ precipitate, while alpha activity imparts a negative charge. (R.V.J.)

9534

STUDY OF THE ELECTROCHEMICAL SEPARATION OF BISMUTH FROM DILUTE SOLUTIONS WITH THE USE OF TRACERS. D. M. Ziv and V. A. Ishina. Radiokhimiya 1, 185-95(1959). (In Russian)

By noting the rate of plating of a given element as a function of electrode potential, the critical solution-plating potentials for Bi from 1.0 N HNO_3 on gold electrodes were determined for a concentration range of Bi from 10^{-13} to 10^{-2} moles/l. It was established that the curve showing a plot of the critical potential ϕ versus concentration of bismuth (C) has three regions; a region of constant ϕ (no clear relationship between ϕ and lg C), a transition region, and a "Nernst region" (plot of ϕ versus lg C is a straight line). An explanation is advanced for the constancy of the critical potential in very dilute solutions (a gradual increase in a film of metal covering the electrode surface with the activity coefficient of the reduced form remaining constant). The formal standard electrode potential of Bi in 1.0 N HNO_3 and the stoichiometric number for the electrode reaction were found to be 0.280 ± 0.0054 and 1.8 ± 0.1, respectively. (R.V.J.)

9535

ATTENUATION AND ADSORPTION OF FISSION FRAGMENTS IN A GAS AS A METHOD OF STUDYING FISSION ISOTOPES. RADIOCHEMICAL STUDY OF THE DISTRIBUTION OF FISSION FRAGMENTS ACCORDING TO RANGE. K. S. Petrzhak, E. B. Nikol'skaya, Yu. G. Petrov, and E. A. Shlyamin. Radiokhimiya 1, 227-30(1959). (In Russian)

A layer of U_3O_8 of ~ 100 $\mu g/cm^2$ was irradiated for 1 to 7 hours at a thermal neutron flux of $\sim 10^{12}$ n_0/cm^2 sec. The fission fragments could be sent through 30 collodion films (each ~ 6 $\mu g/cm^2$) each separated by a distance of 2.5 mm. Various attenuating gases such as air, argon, helium, and hydrogen at different pressures could be used in the equipment. Each collodion film was mounted on an aluminum backing and its activity was counted with an end-window beta counter. The geometry and gas pressure were so selected that the fission fragments with mass numbers 83 to 150 were distributed along the path interspersed by the collodion films. The distribution of activities as a function of the sequential number of the collodion films shows the typical double-peaked curve characteristic of fission. According to calculations, Ba^{140} with the smaller range should fall on the first peak and $Sr^{91,92}$ with the larger range should fall on the second peak. Radiochemical analysis confirmed these calculations. This method considerably simplifies the separation of fission fragments. Thus, Ce need only be separated from Cs, Ba, and rare earths, and not from Zr and Nb. It is not necessary to carry out difficult separations such as Ba from Sr, Cs from Rb, I from Br, and Y from the rare earths. This method can also be used to separate short-lived fission products without carrier. (R.V.J.)

9536

SEPARATION OF RADIOACTIVE MANGANESE WITHOUT CARRIER FROM CHROMIUM IRRADIATED WITH DEUTERONS. L. N. Burtseva, V. I. Levin, M. M. Golutvina, and V. S. Bubnov. Radiokhimiya 1, 231-5(1959). (In Russian)

The separation of radioactive manganese without added carrier from chromium irradiated with deuterons was attempted by oxidizing chromium to chromate and coprecipitating manganese with ferric hydroxide. The iron is separated by extraction with ether. The results indicate that the use of bromine as an oxidizing agent for chromium leads to substantial losses of manganese, which is oxidized also to higher valence states. The yield of manganese is at least 80% if hydrogen peroxide is used to oxidize chro-

mium. Radiochemically pure manganese without added carrier can be prepared by this method. (R.V.J.)

9537

ENRICHED RADIOACTIVE PHOSPHORUS FROM IRRADIATED TRIPHENYL PHOSPHINE OXIDE. V. D. Nefedov, E. N. Sinotova, V. M. Smirnov, and M. A. Toropova. Radiokhimiya 1, 236-8(1959). (In Russian)

Irradiated $(C_6H_5)_3PO$ [TPO] would be expected to contain small amounts of radioactive phosphorus as PO_4^{3-} and PO_3^{3-}. This assumption was confirmed by dissolving an irradiated sample of TPO in chloroform. It was found that 84 to 86% of the radioactive phosphorus could be extracted from the chloroform with water. Conversely, TPO labeled with radioactive phosphorus remained in the organic phase. An enrichment factor of (2 to 3) $\times 10^3$ for phosphorus was obtained by using this method. Also, the TPO sample can be dissolved in alcohol and the radioactive PO_4^{3-} and PO_3^{3-} carried on ferric hydroxide. Iron can be separated on a cation exchanger. (R.V.J.)

9538

RADIOCHEMICAL SEPARATIONS BY AMALGAM EXCHANGE. James R. DeVoe, Chong K. Kim, and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Talanta 3, 298-9 (1960) Jan.

A procedure was developed for the rapid and selective separation of radioisotopes using amalgam exchange. The separation takes place by virtue of the rapid exchange occurring between an element present in a dilute amalgam and its ions in solution. The comparatively easy separation of cadmium from zinc shows the potentialities of this process. Individual amalgams containing milligram amounts of cadmium, thallium, bismuth, strontium, zinc, indium, or lead were found to remove trace amounts of their respective isotopes from dilute acid or salt solution with a yield of at least 50% in five minutes of stirring. Tin and gallium did not exchange. (B.O.G.)

9539

RADIOISOTOPE TECHNIQUES. Ralph T. Overman and Herbert M. Clark. New York, McGraw-Hill Book Company, Inc., 1960. 487p.

Nuclear radiations and their interactions with matter are discussed. Methods of detecting and measuring radiation and the errors arising in radioactivity measurements are considered. The safety hazards in working with radiation are discussed. Methods for preparing and standardizing sources and for calibrating detectors are given. The radioactive decay process is discussed, and experiments for the determination of the half lives of various radionuclides are outlined. Methods of radiochemical separation are contained. The various uses of radioisotopes are described. (C.J.G.)

Raw Materials and Feed Materials

9540 CEA-1091

France. Commissariat à l'Énergie Atomique, Paris.

MINERAI DES BOIS-NOIRS. RÉCUPÉRATION DE L'URANIUM DES SOLUTIONS D'ATTAQUES ACIDES. RÉSULTATS DES ESSAIS INDUSTRIELS EFFECTUÉS A L'USINE DE GUEUGNON. ("Bois-Noirs" Ore. Recovery of Uranium of Solutions from Acid Treatment. Results of Industrial Tests at the Gueugnon Plant). J. Le Bris. Apr. 1959. 40p.

Industrial-scale tests are reported of the efficiency of two recovery processes for the separation of uranium from sulfuric acid pickling solutions used on ore from Bois-Noirs, at the Gueugnon works. The final stage of each process is sodium uranate. The earlier part of the report deals with tests of the separation of uranium from foreign metals by fractional precipitation. The second part deals with the separation of uranium from these metals by carbonation of the solutions. (auth)

9541 CF-58-9-66

Oak Ridge National Lab., Tenn.

PROGRESS REPORT ON THE FLUOROX PROCESS FOR APRIL 30, 1957–JANUARY 14, 1958. J. B. Adams, L. M. Ferris, and C. D. Scott. Sept. 10, 1958. 32p. OTS.

Progress in the Fluorox program is reported. The chemical reaction of primary interest in the Fluorox program is the oxidation of UF_4 with O_2, $2UF_4 + O_2 = UO_2F_2 + UF_6$; however, to study this process at higher temperatures, the thermal decomposition of UO_2F_2, $3UO_2F_2 = \frac{2}{3}U_3O_8 + UF_6 + \frac{1}{3}O_2$, is being investigated by thermogravimetric methods in the temperature range 750 to 900°C. A fluidized bed reactor and a flame reactor have been used successfully to perform the continuous oxidation of UF_4 with O_2. The 3-in. fluidized bed reactor was operated up to 825°C on both a continuous and batch basis while the flame reactor was used to continuously react finely divided UF_4 with O_2 in a CO–O_2 flame at temperatures greater than 1200°C. (auth)

9542 MCW-238

Mallinckrodt Chemical Works, St. Louis.

REPORT OF PILOT PLANT WORK ON UF_4 PRODUCTION BY MEANS OF STIRRED FLUIDIZATION. E. K. Teter. Nov. 15, 1949. Decl. Jan. 28, 1960. 6p. OTS.

Three runs were made, under various conditions, with a stirred fluidizer to see if UO_2 could be fluorinated to UF_4. In the first run, UF_4 was charged first, then the UO_2 added, to see if UF_4 could be made continuously. Difficulty was encountered in discharging the product, dust losses were high, and complete conversion was not obtained. Thorough mixing of UF_4 and UO_2 occurred during the run. The second run was made with UO_2 only. The batch was stopped because of a material-jammed stirrer. The third run was made with a UF_4–UO_2 mixture to see how the conversion rate would compare with present horizontal continuous conveyor equipment. The rate of conversion was lower, also the vertical equipment used far more H and the dust loss was much higher. (auth)

Separation Processes

9543 AECD-4294

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

EFFICIENCY OF A THREE INCH HIGGINS COLUMN. V. C. Vaughen, G. Jansen, and R. O. Bagley. Dec. 20, 1956. Decl. with deletions Oct. 2, 1957. 21p. [For Union Carbide Nuclear Co. K-25 Plant Contract W-7405-eng-26]. (KT-269(Del.)). OTS.

A description of the Higgins semi-continuous ion exchange contactor is given. The operating conditions of the contactor in an experimental run performed with the iron-uranium system are given. The specifications of a recovery column to be used in the final purification and concentration stage of the process plutonium stream are given, and the theoretical efficiency is compared to the efficiency of a three-inch Higgins column. (C.J.G.)

9544 CEA-1092

France. Commissariat à l'Énergie Atomique, Paris.

INFLUENCE DES PHOSPHATES, LORS DE LA PRECIPITATION PAR LA CHAUX, DE L'URANIUM CONTENU

DANS LES SOLUTIONS D'ATTAQUE SULFURIQUE DU FOREZ. (Influence of Phosphates When Uranium in Solutions Obtained by Attacking Forez with Sulfuric Acid is Precipitated by the Action of Lime). G. Brebec. Mar. 1959. 5p.

Influence of phosphates when uranium in solutions obtained by attacking Forez with sulfuric acid is precipitated by the action of lime was studied. Most of the phosphates were eliminated in the form of ferric phosphates without noticeable losses of uranium: for this it is only necessary to add sufficient ferric sulfate to the solution to be treated so that $[Po_4^{3-}]/[Fe^{3+}] \sim 0.4$. In these conditions, the preparation of a calcium concentrate rich in uranium takes place in two stages. The first is neutralization at pH 2.7 to 2.8 with elimination of phosphates, sulfates and iron; the second is precipitation of the concentrate at pH 6.5. (auth)

9545 CF-60-2-12

Oak Ridge National Lab., Tenn.

MATERIAL BALANCE FLOWSHEETS. L. B. Shappert. Feb. 1, 1960. 31p. OTS.

Material balance flowsheets are presented for the dissolution of UO_2, UO_2-ThO_2, and U-Mo fuels clad in stainless steel or zirconium by the Sulfex, Darex, and Zirflex process. The mechanics of the three processes are discussed. Basic assumptions upon which the flowsheets are based are contained. (auth)

9546 HW-62063

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

QUARTERLY REPORT [ON] TECHNOLOGY OF NON-PRODUCTION REACTOR FUELS REPROCESSING BUDGET ACTIVITY 2790. V. R. Cooper. Sept. 24, 1959. Decl. Dec. 2, 1959. 15p. Contract AT(45-1)-1350. OTS.

Current plans for location of the receiving and storage, mechanical treatment, dissolution, clarification, and solution storage at the uranium recovery plant are described. Underwater shearing studies conducted using stainless steel-clad swaged UO_2 fuels to determine the characteristics of the UO_2–water suspension formed during shearing showed that about 3% U may be suspended during normal operation. In life tests, a cold saw was used to cut about the equivalent of the presently scheduled annual processing load of stainless steel without significant blade wear. Optimization of the Zirflex Process to reduce U loss is discussed. Assuming formation of U(IV) in cooled cladding waste at a rate of 10^{-3} moles/(l)(hr) (about ten times greater than is expected from radiolysis), a concentration of 0.01 M hyposulfite at pH 8 would hold the U(VI) concentration to about 1.7×10^{-3} M. Data on Zr dissolution vs. electrical conductivity are presented. Effects of nitrate ions in stainless steel dissolution were studied. It was found that the concentration should not be more than 0.01 M during Sulfex stainless decladding operation. Electrolytic depassivation of stainless steel in sulfuric acid is reported. Evaluation of data from the first series of pilot plant runs involving the dissolution of 304-L stainless by the Sulfex Process indicates that the quantity of hydrogen observed in the off-gas was somewhat lower than stoichiometric quantities. Studies of foam formation in Zirflex and Sulfex Processes are discussed and observations on U–Mo alloy core dissolution are presented along with data on Na–HNO_3 reaction pressures. Darex pilot plant studies on stainless steel clad U core fuel elements were continued. New data on the role of the ferric ion in the Darex Process for dissolution of U–Mo alloys are given. In dissolver studies, dissolution of Hanford slugs in the vertical tube dissolver was initiated and data on dissolution of these slugs in the flooded tray dissolver are tabulated. Observations from corrosion studies of 304-L stainless steel, Hastelloy F, and Ni-o-nel by Zirflex and Sulfex solutions under recirculating dissolver conditions are discussed. In studies of first and second cycle Redox solvent extraction conditions using U–Mo alloy, gross beta and gamma decontamination factors through 2 cycles were ½ and ¼, respectively, of those obtained in a control run employing an acid-deficient flowsheet. Development of a boron monitor was completed. Determination of criticality parameters for 3% enriched U applicable to nuclear safety in reprocessing fuels was continued. Exponential and critical approach measurements were conducted with 0.3 and 0.6 in. diameter enriched rods. A summary of extrapolation length and buckling data is presented. (For preceding period see HW-60298.) (J.R.D.)

9547 HW-62087

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE TRANSFER OF URANYL NITRATE ACROSS THE WATER–TRIBUTYL PHOSPHATE INTERFACE. L. L. Burger. Nov. 15, 1959. 49p. Contract AT(45-1)-1350. OTS.

The transfer of uranyl nitrate and nitric acid across a TBP–water interface of fixed geometry was studied. The variables considered include stirring rates, concentrations of reactants and salting agents, direction of transfer, presence of surface active agents, and temperatures. Results and conclusions are included. (J.R.D.)

9548 HW-63406

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

QUARTERLY REPORT [ON] TECHNOLOGY OF NON-PRODUCTION REACTOR FUELS REPROCESSING BUDGET ACTIVITY 2790. V. R. Cooper. Jan. 20, 1960. 17p. Contract AT(45-1)-1350. OTS.

Current processing concepts were reviewed at an AEC symposium during the period; a report of the symposium is scheduled (TID-7513). Saw studies during the period included coldsaw and hacksaw testing. Preliminary conclusions are listed. Results of Yankee fuel element disassembly scouting experiments are presented along with those for shear basin studies to determine the UO_2 contamination in water. Development of the Zirflex Process is essentially complete. Studies on solution stability and effects of Na ion in Zirflex solutions are discussed along with methods of reducing U loss and results of pilot plant studies. In Sulfex Process development, depassivation studies were continued on 304-L stainless steel. No chemical agents were found to activate passive surfaces in 4 M H_2SO_4; however, coupling this alloy to carbon steel, Hastelloy F, or Ni-o-nel produced depassivation. Pilot plant and bench-scale dissolution studies using 304-L and 347 stainless steel in various H_2SO_4 concentrations are reported. Core dissolution studies were continued with U–Mo alloys. Various ions were tested for their ability to complex molybdate ion formed during HNO_3 dissolution. Other experiments using 12 to 15 M HNO_3 on Al–Mo–U alloys are also reported. Experiments on recirculating dissolvers with reservoirs are reported. Highest dissolution rates were obtained using a well agitated dissolver and plug-flow reservoir. Continued development of the vertical tube and flooded tray dissolvers is reported. Experiments to determine the effects of an additional column on a common reservoir dissolver indicated that the tubes did not affect each other. Corrosion testing of construction materials such as Ni-o-nel, Hastelloy F, and 304-L stainless steel in various process acid and salt solutions was continued. Analysis of data

from precision level experiments was completed and accuracy estimates are tabulated for the case of a storage tank. The determination of criticality parameters for 3% enriched U applicable to nuclear safety in reactor fuel reprocessing was continued. Data on critical mass and buckling and exponential measurements on 0.175 in. diameter heterogeneous rods are tabulated. Preliminary results of similar experiments with homogeneous systems are also given. (For preceding period see HW-62063.) (J.R.D.)

9549 ORNL-2822

Oak Ridge National Lab., Tenn.

DECLADDING OF CONSOLIDATED EDISON POWER REACTOR FUEL BY SULFEX AND DAREX PROCESSES: CYCLIC DISSOLUTION EXPERIMENTS. L. M. Ferris. Based on data obtained in corrosion studies at Battelle Memorial Institute under Subcontract 988 by C. L. Peterson, P. D. Miller, J. D. Jackson, and W. C. Baytos. 12p. Contract W-7405-eng-26. OTS.

Simulated Consolidated Edison reactor fuel pins (95.5% ThO_2-U_3O_8 pellets encased in 304L stainless steel) were dissolved one-by-one according to the Sulfex and Darex flowsheets in Ni-o-nel and titanium vessels, respectively, 25 pins by each process. With boiling 5 M HNO_3–2 M HCl (Darex), dissolution of the cladding was complete in each cycle with uranium losses of 0.1–0.4%. Dissolution of the ThO_2-U_3O_8 core pellets (which were about 80% of theoretical density) in boiling 13 M HNO_3–0.04 M NaF–0.04 M $Al(NO_3)_3$ was also complete in each case. No problems arose from passivation of stainless steel or cross-contamination of solutions. Two modifications of the Sulfex process were tested including decladding with 200% excess of 6 M H_2SO_4, and initiating the reaction with 6 M H_2SO_4 and diluting to 4 M sulfate shortly thereafter. Uranium losses to the decladding solution were generally between 0.2 and 0.5% irrespective of the technique, but were as high as 0.9% in the presence of a ThO_2–U_3O_8 heel. The uranium losses were directly related to the amount of heel present. In most cases the fuel pins were passive to boiling 6 M H_2SO_4 and reaction was initiated by contacting the pin with a piece of iron. Core dissolution was less efficient than in the Darex tests, presumably because of sulfate contamination. Under the flowsheet conditions only 98 to 99% of the core was dissolved in each cycle. (auth)

9550 ORNL-2843

Oak Ridge National Lab., Tenn.

PURIFICATION OF Pm^{147} FROM FISSION-PRODUCED RARE EARTHS. R. S. Pressly. Mar. 15, 1960. 12p. Contract W-7405-eng-26. OTS.

Promethium is purified from inactive and radioactive long-lived fission-produced rare earths by the use of Dowex 50 or Nalcite HCR cation exchangers and organic eluants. Americium and promethium, having hydrated ionic radii of the same size, are contained in the same fraction of the eluate. Promethium is purified from americium by adsorbing both elements on Dowex 1 (thiocyanate form) and eluting promethium from the resin with ammonium thiocyanate solution. Equilibrium studies were made in order to determine distribution coefficients of the long-lived radioactive rare earths. Elution curves based on analyses of solutions removed from anion and cation exchangers verify the relative values of the distribution coefficients. From Dowex 1 resin, rare earths 58 through 63 elute with ammonium thiocyanate in the order of increasing atomic number. Conditions are established for the expansion of the present 50- to 100-curie-level processing to levels of 1000 to 5000 curies. (auth)

9551 RISLEY-5057/3

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.

THE DISSOLUTION OF CAST URANIUM RODS IN 3N NITRIC ACID CONTAINING 0.3GM. URANIUM PER MILLILITRE. (Third Interim Report). J. H. Tonkin. Sept. 22, 1949. 33p.

Experiments to establish the dissolving rate of cast uranium rods under continuous conditions to yield a liquor containing 0.3 g U/ml in 3N nitric acid are described. Results indicate that further investigation of control methods is required. Factors affecting the design of a full-scale plant are discussed. (J.R.D.)

9552 SCS-R-75

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE CHROMATOGRAPHIC SEPARATION AND CONCENTRATION OF URANIUM USING FILTER PAPER CONES. R. E. Worthington, H. E. Dibben, H. Mason, A. P. Seyfang, and D. Swallow. Aug. 17, 1949. 6p.

Chromatographic separation of uranium using a filter paper cone is described. The best solvent appears to be ether containing nitric acid. (J.R.D.)

9553

INVESTIGATION OF THE EXTRACTION OF THE COMPLEX OF LANTHANUM WITH BENZOYL ACETONE. J. Starý (Charles Univ., Prague). Collection Czechoslov. Chem. Communs. 25, 86-92(1960) Jan. (In German)

On the basis of an investigation of lanthanum extraction with benzoyl acetone in three organic solvents ($CHCl_3$, C_6H_6, and CCl_4), the stability constants K_N and the distribution coefficient Q of the complexes of lanthanum with benzoyl acetone were determined by means of the Leden and Dyrssen-Sillen methods. The experimentally found K_N and Q values approximate very closely the theoretically predicted values. An extraction method for the separation of carrier-free, radiochemically pure La^{140} from fission Ba^{140} was worked out. (tr-auth)

9554

EXTRACTION FROM SOLUTIONS OF PERCHLORIC ACID BY TRIBUTYLPHOSPHATE. I. PARTITION COEFFICIENTS FOR ZIRCONIUM, THORIUM, CERIUM, PROMETHIUM AND YTTRIUM. S. Siekierski (Inst. of Nuclear Research, Warsaw). J. Inorg. & Nuclear Chem. 12, 129-35 (1959) Dec.

Zirconium, thorium, cerium, promethium, and yttrium are well extracted by TBP from concentrated solutions of perchloric acid. Partition coefficients increase steadily with increasing acid concentration, except at low acidities. Thorium is better extracted than zirconium and the ratio of partition coefficients is constant at all acidities. Cerium and promethium have the same partition coefficient, and the coefficient for yttrium is somewhat smaller. (auth)

9555

THE INFLUENCE OF DILUENT POLARITY ON EXTRACTION OF PLUTONIUM COMPLEXES TO ORGANIC MEDIA. M. Taube (Inst. of Nuclear Research, Warsaw). J. Inorg. & Nuclear Chem. 12, 174-80(1959) Dec.

The influence of the polarity of diluents on the extraction of plutonium(IV) complexes from nitric acid solution with tri-n-butylphosphate, di-n-butylphosphate, thenoyltrifluoroacetone, tetra-n-butylammoniumnitrate, and methylisobutylketone was examined. Diluents such as carbon tetrachloride, chloroform, benzene, cyclohexane, n-heptane, bromoform, and dibromoethane were used singly and in mixtures. Evidence is presented for the importance of the dipole moment of the diluent in the extraction process in

connection both with the structure of the organic phase and dipole-dipole interaction promoting solvation of the Pu-complex. Maxima exist in the extraction of Pu-TBAN complexes to phases containing mixtures of polar diluents with non-polar diluents and in particular with benzene. (auth)

9556

SEPARATION OF URANIUM BY REVERSED PHASE-PARTITION CHROMATOGRAPHY. A. G. Hamlin and B. J. Roberts (United Kingdom Atomic Energy Authority, Capenhurst Works, Ches., Eng.). Nature 185, 527-8(1960) Feb. 20.

The use of tributyl phosphate on a partition chromatographic column proved to be a convenient and selective method for the separation of uranium from a nitric acid solution. The use of the partition chromatographic column reduced the hazard of manipulating radioactive material, improved the partition of uranium into the organic phase, and had the effect of a large number of manual solvent extractions. (C.H.)

9557

SEPARATION OF URANIUM FROM IRON AND VANADIUM. K. Singh and D. Patnaik (Ravenshaw Coll., Cuttack, India). Proc. Indian Acad. Sci., Sec. A 50, 358-62(1959) Dec. (In English)

The separation of uranium from iron and from vanadium was carried out by photolysis. A mixture of the solutions of uranium and iron or vanadium with ammonium bifluoride containing different percentage of alcohol was exposed to sunlight for 4 to 5 hours. Uranium precipitated in the form of a hydrated complex fluoride, leaving iron and vanadium in the solution phase. Uranium of at least 99.9% purity was obtained on photolyzing solutions having pH 2.0 to 2.5. The important factor for the percentage of recovery is the composition of the solution. With 30% alcohol the yield comes to about 93.5%. (auth)

9558

Argonne National Lab., Lemont, Ill.
REACTOR FUEL PROCESSING. Technical Progress Review, Vol. 3, No. 1. Stephen Lawroski, ed. 61p. $0.55(GPO) (domestic), $0.70(GPO) (foreign).

In the commercial aspects of fuel processing the following subjects are discussed: interim processing plans, cost information, uranium procurement and production statistics, waste-disposal licensing, scrap recovery contracts, and radioactive shipments. Mechanical processing, chemical dejacketing, and dissolution are discussed in relation to preparation of fuel for reprocessing. In research and development on fuel reprocessing solvent extraction, ion-exchange processes, volatility processes, pyrometallurgical processing, liquid metal fuel reactor processing, homogeneous reactor processing, plant design, instrumentation, equipment development, and corrosion are presented. In waste disposal the following subjects were presented at Congressional hearings: U mill effluents, reduction to solids, final disposal methods, and separation of specific isotopes. The production of UF_6, UF_4, U, and Pu metals and U recovery from slags is discussed. (W.L.H.)

9559

PRODUCTION OF AQUEOUS URANYL SULPHATE SOLUTION FROM URANIUM DROSS. (to United Kingdom Atomic Energy Authority). British Patent 829,087. Feb. 24, 1960.

A process for recovering U from scrap and U-production dross is offered. The U-containing material is burnt to oxide in air, mixed with lime, roasted at 600 to 1000°C, and mixed with H_2SO_4. After pH adjustment and filtering, the UO_2SO_4 solution can be converted to peroxide. (T.R.H.)

9560

SEPARATION OF URANIUM PEROXIDE FROM MIXTURES. (to United Kingdom Atomic Energy Authority). British Patent 829,088. Feb. 24, 1960.

A process is presented for extracting U from an aqueous uranyl sulfate solution. The process removes ions which interfere with precipitation of peroxide from the sulfate solution. The U^{4+} is oxidized to U^{6+} by H_2O_2, and the solution heated to 90 to 95°C. Over a two-hour period $CaCO_3$ powder is added to bring the pH from 1.0 up to 3.7 to precipitate Fe. In other examples, procedures for removing B, Cu, Co, Cr, Mo, Mn, Ni, Cd, Li, Hg, La, V, Ga, and Sm are given. (T.R.H.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

9561 AERE-R-2870

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
SURVEY OF DIRECT ECONOMIC ADVANTAGES FROM THE USE OF ISOTOPES IN BRITISH INDUSTRY. J. L. Putman and N. W. Jollyman. Mar. 1959. 10p.

A survey was made to estimate the cash savings, both direct and indirect, which are being made by the use of radioisotope techniques in British industries operating in the U.K. (W.L.H.)

9562 AFBMD-TN-60-1

Avco Corp. Avco-Everett Research Lab., Everett, Mass.
AN EXPERIMENTAL MAGNETOHYDRODYNAMIC POWER GENERATOR. Richard J. Rosa. Jan. 1960. 9p. Contract AF04(647)-278. (AMP-42).

An experimental magnetohydrodynamic (MHD) generator that was constructed at the Avco-Everett Research Laboratory is described. Some basic aspects of its performance are summarized. Included is a discussion of the term efficiency as applied to MHD generators. (auth)

9563 MND-P-2101-III

Martin Co. Nuclear Div., Baltimore.
SNAP-III—THERMOELECTRIC GENERATOR ENVIRONMENTAL TEST. VOLUME III. Louis W. Gross and Eugene J. Schramm. Jan. 1960. 73p. Contract AT(30-3)-217. OTS.

The results of tests on four thermoelectric generators (two each of two different configurations) of the Snap III type to both the J.P.L. and the L.M.S.D. specifications for shock, vibration, and acceleration test are reported. The simulated levels were based on the anticipated environments of the Vega (J.P.L.) and WS117L (L.M.S.D.) systems. All four generators exhibited the same characteristic behavior pattern throughout the vibration portion of the test program, showing a d-c ripple in the generator output only in the Y plane. This behavior of the generator is attributed to the oscillatory change in internal resistance resulting from vibratory elastic deformation of the thermoelectric elements. This produces a transient in the electrical output with a resultant reduction in generator efficiency. The maximum reduction in efficiency was noted in the 700 cps region. A resonance on the generator shell at 1845 cps was noted, but generator electrical output and efficiency were not affected. Upon discontinuance of the induced vibration, the generators returned to normal operating conditions. While undergoing shock test, a d-c transient was noted at the time of impact, resulting in a slight decrease in effi-

ciency. The generators immediately returned to their normal operating efficiency. In the acceleration portion of the test no d-c transient was evident in any of the three planes, therefore the generator efficiency remained constant. Steady state conditions were re-established at the start of each new test phase (i.e., changing planes of excitation, changing from shock to vibration, etc.). Thus, any variation from pretest efficiency was attributed to the external load resistance becoming unmatched due to the change in internal resistance. The important result is that complete generator recovery was consistent in all cases and normal operation continued. The generator, shell, internal structure and pressure, and the hot and cold junction temperature were not affected during the test. As a result of this test program, it was concluded that the Snap III thermoelectric generator will operate reliably in the environments associated with the Vega and WS117L vehicles. (auth)

9564 IGIS-64(RD/R)

GRAPHITE SEALS FOR ROTATING SHAFTS. L. A. Plutalova. Translated by O. Routledge (U.K.A.E.A., (Risley) from Vestnik Mashinostroyeniya 37, No. 2, 3-8 (1957). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7218.

9565

LUMINESCENCE SPECTRUM OF CsI. D. Chauvy and J. Rossel (Université, Neuchâtel, Switzerland). Helv. Phys. Acta 32, 481-5(1959). (In French)

Investigations on the luminescence of pure CsI crystals have established the existence of a "cold" component with a rapid exponential decay slightly influenced by temperature and of a "hot" component only detectable at normal temperature with a much slower decay and strongly dependent on temperature. The results of the measurement of the spectral distribution of the light emitted and the yield for each of the spectral rays are presented. The results on the appearance of the different rays, the diverse origins of the original materials, and the spectroscopic analysis of the powders and crystals used confirm the hypothesis that the luminescent centers are bound to crystalline faults and not to chemical impurities. The ray in the vicinity of 3500 A seems to correspond to a mechanism of energy transport and de-excitation characteristic of the basic cell and more or less independent of its imperfections. The ray at 3260 A, which constitutes with the 3500 A ray the cold component, is probably bound to a similar mechanism, but one much more sensitive to the crystal faults. These indications are not contrary to the hypothesis advanced of a recombination of excitons degenerated and trapped in the crystal. The cold component, constituted by the ray close to 4370 A, is produced by imperfections of another type introduced by thermal treatment and absent from the crystal obtained from solution. (J.S.R.)

9566

TRACERS TEST EFFICIENCY OF AIR-COMPRESSOR FILTERS. Ralph L. Ely, Jr. (Nuclear Science and Engineering Corp., Pittsburgh) and Jerome R. Pier (Westinghouse Air Brake Co., Pittsburgh). Nucleonics 18, No. 3, 130; 132-3(1960) Mar.

A study was conducted of filter efficiency in high-speed and high-temperature air compressors. Oil particles tend to form varnishlike deposits in critical parts of airbrake equipment. A tracer of Sb^{124} in triphenylstibine was used to evaluate the efficiency of each filter tested. The method used in the testing of the filters is presented. (B.O.G.)

9567

A UNIVERSITY LABORATORY FOR HANDLING STRONGLY RADIOACTIVE MATERIALS IN WEIGHABLE QUANTITIES. F. Weigel (Universität, Munich). p.51-66 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In German)

A laboratory is described which was built at the Institute for Inorganic Chemistry, Munich University, for research with strongly radioactive materials. This laboratory, which is arranged somewhat like UCRL, will conduct basic research with weighable quantities of Po, Ra, Pa, and transuranic elements. X-ray structural analyses of compounds of these elements as well as thermochemical and preparative studies will be emphasized, especially the synthesis of new compounds. The layout, equipment, and equipment arrangement are described and depicted. (T.R.H.)

9568

MECHANISM FOR TRANSMITTING MOTION THROUGH A PHYSICAL BARRIER. (to Atomic Energy of Canada, Ltd.). British Patent 825,196. Dec. 9, 1959.

A system for transmitting mechanical movement through a barrier wall to an expensive, toxic, corrosive, or radioactive liquid without leakage is described. A liquid-filled chamber with a wall common to the barrier wall contains a motor and a drive which is sealed with a movable seal through the barrier wall. A free-piston, bellows, or diaphragm equalizes fluid pressures between the two chambers without mixing. Other features which facilitate operation and maintenance of the device are described. (T.R.H.)

9569

IMPROVEMENTS IN OR RELATING TO PIPE COUPLINGS. George Edward Marchment and Harrison John Hall-Wilton. (to United Kingdom Atomic Energy Authority). British Patent 828,940. Feb. 24, 1960.

A flange and O-ring pipe coupling is described. A flange is screwed on each pipe to be joined, and the flange is welded to an unthreaded extension pipe to prevent liquid flowing in the pipes from contacting the threads. These flanges are shaped to accommodate a sealing ring. (T.R.H.)

Heat Transfer and Fluid Flow

9570 NASA-TN-D-265

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

EXPERIMENTAL RESULTS OF A HEAT-TRANSFER STUDY FROM A FULL-SCALE PEBBLE-BED HEATER. Richard B. Lancashire, Erwin A. Lezberg, and James F. Morris. Mar. 1960. 22p. OTS.

Data were obtained from the initial operation of a large regenerative pebble-bed heat exchanger in order to determine the heat-transfer characteristics of a packed bed of spheres. The facility, designed to produce high-temperature air for hypersonic flight research, is described in detail. The heat-transfer analysis and results are presented and compared with those of other investigators. (auth)

9571 NYO-2136

Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.

THERMAL CONDUCTANCE OF METALLIC SURFACES IN CONTACT. Henri Fenech and W. M. Rohsenow. May 1959. 176p. D.S.R. Project No. 5-7795. Contract AT(30-1)-2079. OTS.

A method is developed for the determination of the thermal conductance of metallic surfaces pressed together. A mathematical analysis of a thermal contact is carried-out on an idealized shape of contact point. A method is outlined to determine the physical properties of a contact and to find their dependence on the pressure applied on the contact. Experimental work carried out is described. Some further remarks are given on thermal contacts and the effect of surface oxidation on the electrical and thermal resistance of the contact. (W.D.M.)

9572 IGIS-12(RD/R)

HEAT TRANSFER IN A HORIZONTAL SHAFT HEATED AT ONE END. K. Meiners. Translated by D. H. Hill (U.K.A.E.A., Risley) from VDI Zeitschrift 99, 667-71(1957). 14p.

Data on heat transfer in horizontal shafts heated at one end are presented including calculations of the flow in both rotating and stationary shafts. (J.R.D.)

9573

THE CALCULATION OF "HOT-CHANNEL FACTORS" IN REACTOR FUEL ELEMENTS. J. Clauss. Atomkernenergie 5, 41-52(1960) Feb. (In German)

"Hot channel factors" are additional factors which compensate for thermal uncertainties in the design of an atomic reactor. These uncertainties arise from physical and technical peculiarities, such as the distribution of the neutron flux, its local deviations which cannot be calculated exactly in advance, the tolerances in the dimensions of the core subassemblies, material qualities which are not known exactly, the distribution of the cooling agent on the various cooling channels, and other effects. The physical proportion of the hot-channel factors is not discussed. It varies considerably from one reactor type to the next, and can be determined quite accurately in individual cases, especially by experiments. The technical factors, too, naturally depend a lot on the reactor type, or more accurately, on the type of fuel elements and cooling channels, respectively. Almost all fuel elements, however, can be traced back to the geometry of the plate or the cylinder, so that the technical factors can be calculated in a relatively simple way. If the physical factors are then known, there are two methods for calculating the temperature at the hot spot, the product method and the statistical method. The sum of the individual deviations resulting from the last-mentioned method for calculation gives a third possible value of maximum temperature on a certain spot of the hot channel. (auth)

9574

BOUNDARY VALUE PROBLEMS IN THE CALCULATION OF THE THERMAL STRESSES IN REACTOR PRESSURE VESSELS. D. Radaj (Technische Hochschule, Hanover). Atomkernenergie 5, 53-7(1960) Feb. (In German)

Pressure tanks of nuclear reactors generally are composed of a cylinder being covered at both ends with hemispherical bottoms. Under influence of temperature gradients both cylinder and bottoms dilate radially at different rates. Thus deformation hindrances and because of them an increase of stress occur. A formula concerning the quantity of the stress increase is derived, and the validity range of the boiler formula is outlined. (auth)

9575

HEAT TRANSFER FROM ARCS. J. B. Wilkinson and D. R. Milner (Birmingham Univ., Eng.). Brit. Welding J. 7, No. 2, 115-28(1960) Feb.

The energy distribution for arcs between a non-consumable tungsten cathode and a water-cooled copper anode was determined in atmospheres of argon, nitrogen, helium, and hydrogen. In general, 80 to 90% of the energy expended in an arc of this type was found to go to the anode, with the remainder divided between the cathode heating and the heat carried away by the gas, which leaves the arc region at temperatures of the order of 1000 to 6000°K. The investigation was directed to the examination of the heat flow to the anode, which comprises the electron heating, together with heat transfer from a plasma jet which originates from the constriction of the current caused by the cathode spot. The velocity and diameter of the jet in argon arcs were determined at the anode by comparing the pressure increase it creates with that caused by jets of known velocity and extent. It was found that the jet velocity is of the order of 10^4 cm/sec, and the diameter a few millimeters. The intensity of the jet in dissociable gases made measurements impossible because of the rapid erosion of the apparatus. For argon arcs the heat transfer from these high-velocity, high-temperature jets was separated from the heating caused by the electron stream in experiments with a three part anode, in which a center section received the electron heating together with some plasma jet heating, while a surrounding annulus was heated only by the plasma jet. Conventional heat transfer concepts were applied with some success to the interpretation of the data on heat transfer from the jet to the cooled anode. It is suggested that jets of this type in dissociable gases are responsible for deep-penetration effects in welding. (auth)

9576

BINDING ENERGY OF LIGHT HYPERFRAGMENTS AND NUCLEON–HYPERON FORCES. F. Ferrari and L. Fonda (Universitá, Padua and Universitá, Trieste, Italy). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IX-42-3. (In English)

Following an earlier investigation concerning the kind of forces which are responsible for the binding of the light hyperfragments, a further theoretical calculation was made on the same subject, with the aim of discussing somewhat more accurately the relative importance of the binding through pions and K mesons. (W.D.M.)

Instrumentation

9577 AD-215595

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

MICROWAVE CAVITY DETECTOR FOR RADIATION (thesis). Thomas Dean Scapes. Mar. 1959. 50p.

The effect of 10^5 r/hr cobalt-60 gammas on a resonating microwave cavity was determined by observing the change of the cavity Q. It is shown theoretically and experimentally that the Q of a gas filled cavity decreases when the device is exposed to ionizing radiation. Due to the error introduced by the applied measurement technique, it was not possible to make quantitative comparisons of the changes of Q for different dose rates. Possible alternate techniques of observing the effect of gamma radiation on a microwave cavity are discussed. (auth)

9578 ANL-6106

Argonne National Lab., Lemont, Ill.

A STUDY OF TECHNIQUES AND THE DEVELOPMENT OF EQUIPMENT FOR DECANNING EBR-II FUEL ELEMENTS. J. P. Simon. Jan. 1960. 21p. Contract W-31-109-eng-38. OTS.

Remotely operated, semi-automatic machines, designed

to effect the mechanical disassembly (i.e., decanning) of spent fuel elements from the Experimental Breeder Reactor-II, were developed. The machines described are laboratory models which successfully decanned simulated fuel elements. They are electrically or pneumatically operated and are capable of decanning three fuel elements per minute without the routine use of manipulators. Each machine is made up of functional units which are sequentially placed to eliminate handling between steps of the decanning operation and which are easily removable for replacement or maintenance. In the first of the two machines described, pneumatically operated devices prepare the fuel element for a rotary shearing operation which cuts the tubing jacket along a helical circumferential path as it is being removed. The alternate machine removes the jacket by means of a series of shearing rolls. Both machines are served by auxiliary mechanisms, such as inspection jigs, fuel and scrap choppers, and transfer magazines. (auth)

9579 DEGR-57(CA)

United Kingdom Atomic Energy Authority. Development and Engineering Group, Capenhurst, Ches., England.

A MOLECULAR BEAM ION SOURCE FOR HEX ANALYSIS WITH A MASS SPECTROMETER. J. A. McKnight. Nov. 18, 1959. 25p. BIS.

Declassified version of IGR-R/CA-243.

The routine use of mass spectrometers for hex analysis in the U.K.A.E.A. has emphasized the two major difficulties of conventional practice. First, the action of hex is to corrode metals, leading to interference with their electrical properties. Secondly, the products of such corrosion interfere with subsequent measurements, causing the effect known as "memory." It has been found that the mass spectrometer ion source is the chief cause of these difficulties, and this report describes a new design of ion source which is the subject of a patent application. By reconstructing the ionizing assembly in a skeletal form the action of hex has been greatly reduced. A unique feature of this sytem is that the sensitivity and resolution properties for hex are unimpaired. Tests have shown that the ion source can have a hex life at least three times as long as that of a conventional ion source used under the same conditions. The memory effect is greatly reduced in magnitude, and can be calibrated, unlike that in a conventional ion source. Practical information is given concerning the construction and operation of the ion source. Suggestions are made toward improving the performance even further. (auth)

9580 DP-450

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

A REMOTELY CONTROLLED METALLOGRAPH. [PART] II. W. Harold Leith. Dec. 1959. 15p. Contract AT(07-2)-1. OTS.

A Bausch and Lomb metallograph that had been adapted so that it could be operated remotely was modified further to facilitate its operation. The instrument has performed satisfactorily in the examination of highly radioactive materials behind the heavy shielding of a high level cell. (auth)

9581 HW-60404

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PORTABLE RADIATION INSTRUMENTATION STANDARDIZATION. W. G. Spear. Sept. 1, 1959. 35p. Contract AT(45-1)-1350. OTS.

Development and testing of count-rate-meter type transistorized radiation detection instruments with printed, modular circuits are described. Several of the instruments are multipurpose, and all transistorized circuitry is completely interchangeable from one type instrument to another. Other aspects of standardization in these instruments, used for detecting and measuring alpha and beta particles, gamma photons, and neutrons, are also discussed. Circuit diagrams are included. (J.R.D.)

9582 IDO-16573

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SELF-BALANCING RESISTIVITY MEASURING SET. T. J. Boland, A. W. Magnuson, and T. T. Davis. Feb. 15, 1960. 24p. Contract AT(10-1)-205. OTS.

A self-balancing bridge was developed to provide a means of detecting changes in the electrical resistivity of sample materials due to irradiation. A current source supplies a known constant current to the test sample. This current produces a voltage drop across the sample as a result of the resistance of the sample between the voltage contacts. The self-balancing system balances the voltage drop to an equal voltage from a calibrated reference source in the balancing network. For a standard sample size, the three current ranges (10, 1, and 0.1 amp) of the instrument provide full-scale ranges of from zero to 50, 500, and 5000 μohms. This corresponds to full scale resistivity reading of 6, 60, and 600 μohms-cm. Should it become necessary to measure lower resistivity samples, or samples of larger cross section, the sensitivity can be increased by a factor of ten to give a resistivity of 0.6 μohms-cm full scale or 0.0006 μohms-cm per dial division. (auth)

9583 KY-296

Union Carbide Nuclear Co. Paducah Plant, Ky.

A NEW POWER REVENUE METERING CONCEPT. R. J. Thomas. June 18, 1959. 20p. Contract W-7405-eng-26. OTS.

The large quantity of electrical power required by the Paducah Plant gaseous diffusion process equipment has presented problems in revenue metering and controlling of the plant load which cannot be answered by the use of standard, commercially available demand metering equipment. A concept of power metering utilizing existing integrators and digital computer techniques was applied to result in the power load anticipator that has satisfactorily solved the problems existing with the standard type revenue meters. (auth)

9584 KY-322

Union Carbide Nuclear Co. Paducah Plant, Ky.

OPERATIONAL HISTORY OF THE PADUCAH PLANT POWER LOAD ANTICIPATOR FROM JULY 1958 THROUGH AUGUST 1959. E. M. Jones and R. J. Thomas. Mar. 4, 1960. 26p. Contract W-7405-eng-26. OTS.

The experienced reliability of a new digital demand metering instrument relative to accuracy, dependability, and other applications is compared with the existing commercial revenue demand metering system employed at the Paducah Gaseous Diffusion Plant. The instrument, called the power load anticipator, was pioneered by personnel of the Paducah Plant and has been in operation over a year. (auth)

9585 ORNL-2877

Oak Ridge National Lab., Tenn.

LARGE AREA GERMANIUM SURFACE-BARRIER COUNTERS. F. J. Walter, J. W. T. Dabbs, and L. D. Roberts. Feb. 25, 1960. 29p. Contract W-7405-eng-26. OTS.

A description is given of a solid-state counter of good resolution, long term stability, and fast rise time which is suitable for heavy charged particles, for example, alpha particles and fission fragments. A simple theoretical

model for the counter behavior is presented which is found to describe the observed behavior of the counter very well. The importance of germanium purity in connection with pulse height, rise time, and counter area is discussed. Counters with sensitive areas up to 5 cm^2 have been successfully used. (auth)

9586 SCTM-39-59(51)
Sandia Corp., Albuquerque, N. Mex.
A FAST CLOSING MECHANICALLY OPERATED ELECTRICAL SWITCH UTILIZING A DIFFERENTIAL PRESSURE PRINCIPLE. PERFORMANCE OF THE FIRST EXPERIMENTAL MODEL. W. J. Halpin and R. E. Hendricks. Apr. 6, 1959. 44p. Contract [AT(29-1)-789]. OTS.

An idea for a fast closing mechanically operated electrical switch that utilizes a differential pressure principle was previously discussed in SCTM 198-58-(51). In this report the idea is further discussed, and results of tests with the first experimental model, the DPS-1, are presented. When voltage standoff across the switch terminals as high as 100 kv is required, it is shown that closure can be effected in times less than 100 microseconds with ordinary "bottle" pressure sources. If pressures of the order of 12,000 psi (insulating material compressive strength limit) are used, it is estimated that the same closure can be accomplished in less than 10 microseconds. An estimate is made from contact resistance tests that the model will pass electrical action ($\int i^2\,dt$) equivalent to a million amperes flowing for 200 microseconds. It is predicted that the switch size can be scaled upward while the relationships between required voltage standoff and closure time are maintained. It is shown that the action capability should increase as the square of the area of the switch contacts. It is concluded that the DPS-1 tests are encouraging enough to warrant more work on the general differential pressure switch idea, and the work that should be done is outlined. (auth)

9587 CEA-tr-R-780
OSCILLOGRAPHE DE HAUTE RAPIDITÉ. (Oscillograph for High Velocities). Ya. M. (Ia.) Balats, P. I. Lebedev, and Yu. (Iu.) V. Obukhov (Oboukhov). Translated into French from Pribory i Tekh. Ekspt. No. 2, 63-7(1957). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 8568.

9588 CEA-tr-R-788
INTÉGRATION DES COURANTS FAIBLES. (Integration of Small Currents). A. A. Kurashov (Kourashov) and A. F. Linev. Translated into French by B. De Trezvinsky from Pribory i Tekh. Ekspt. No. 2, 70-4(1957). 16p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 8569.

9589 IGIS-57(RD/W)
PREPARATION OF VERY THIN ELECTRICALLY-CONDUCTING PREPARATION BACKINGS FOR ABSOLUTE BETA COUNTING. E. Huster and W. Rausch. Translated by G. P. Cook (U.K.A.E.A., Risley) from Nuclear Instr. 3, 213-17(1958). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2334.

9590 UCRL-Trans-519
BUBBLE CHAMBER WITH AN IMPULSE MAGNETIC FIELD. K. N. Mukhin, R. S. Shliapnikov, and L. M. Barkov. Translated from a publication of the Inst. of Atomic Energy, Moscow, 1959. 40p. (Includes original, 27p.). JCL or LC.

The structure of a propane bubble chamber 46 × 21 × 10 cm in size with an impulse magnetic field is described. The chamber works with a 10-second cycle. The magnetic field has the form of a damped sinusoid with the period ≃ 25 milliseconds and the maximum amplitude ≃ 10,000 gauss. The variation of the field maximum value from cycle to cycle does not exceed 1%. The space nonuniformity of the field does not exceed 10%. (auth)

9591
A SENSITIVE GAMMA-RAY DOSIMETER. Bruce L. Blanks and R. H. Rohrer (Emory Univ., Atlanta). Am. J. Roentgenol., Radium Therapy Nuclear Med. 83, 581-2(1960) Mar.

A technique is described for measuring gamma radiation dose rates in phantoms and body cavities which require the use of a probe which does not appreciably disturb the radiation distribution. The design of a scintillation detector and lucite light guide is presented and a block diagram of the complete system is included. (C.H.)

9592
VISCOSITY AND THERMAL CONDUCTIVITY OF LIQUID BORON TRIFLUORIDE. A. N. Spencer and M. C. J. Todd (United Kingdom Atomic Energy Authority, Capenhurst, Ches., Eng.). Brit. J. Appl. Phys. 11, 60-4(1960) Feb.

The thermal conductivity and viscosity of liquid boron trifluoride was measured at −127 to −100°C. The apparatus used in the measurements is described. (C.J.G.)

9593
A COMPACT FREE-AIR CHAMBER FOR USE IN THE RANGE 10-50 KV. J. R. Greening (Edinburgh Univ. and South-East Regional Hospital Board, Edinburgh). Brit. J. Radiol. 33, 178-83(1960) Jan.

A free-air chamber is described which embodies a new field-guarding method not previously applied to practical free-air chambers. A compact design is achieved which facilitates the use of the chamber for the direct measurement of in-air outputs of x-ray units operated under clinical conditions. The design factors of the instrument and its performance are discussed. (auth)

9594
SMOTHERING OF THE COUNTER-EMISSION IN COMPRESSED AIR. APPLICATION TO HIGH VOLTAGE GENERATORS AND TO ELECTROFILTERS. Nguyen-Trinh Dzoanh (Centre National de la Recherche Scientifique, Paris). Compt. rend. 250, 1001-3(1960) Feb. 8. (In French)

The very unfavorable effect of the counter-emission when it occurs progressively in the ionizer of high-voltage machines with electrified particle current or in electrofilters is analyzed. Electrofilters are not paralyzed by the counter-emission, but their efficiency is greatly lessened. A suppression of several kilograms per centimeter squared can smother this undesirable phenomenon completely. (tr-auth)

9595
STUDIES OF THE LOCAL CHARACTERISTICS OF PHOTOMULTIPLIERS. Pierre Cachon (Université, Algiers). Compt. rend. 250, 1004-6(1960) Feb. 8. (In French)

An apparatus is described which is used to study the characteristics of photomultipliers in normal operating conditions. The apparatus allows the mapping of the sensitivities and delays of the photocathode with respect to the multiplier. In diagramming the useful surface of the photocathode by the input optics of the photomultiplier, it was possible to establish the chart of the photomultiplier background. (tr-auth)

9596

A SIMPLE SPECTROMETER FOR NUCLEAR MAGNETIC RESONANCE. Rudolf Becherer (Laboratoire d' Électronique et Radioélectricité, Paris). Compt. rend. 250, 1037-9(1960) Feb. 8. (In French)

An improvement of the Bloch spectrometer is proposed which permits the obtention of signals of equivalent quality without the necessity of severe uncoupling conditions between the emitter and the receptor. The new apparatus utilizes directly a synchronous detector operating with the high frequency signal. A block diagram showing the principle of the spectrometer is given, and the circuitry is also shown. The advantages of the spectrometer are discussed. (J.S.R.)

9597

PHOTOMETRIC MEASUREMENT OF TRACK THICKNESS IN NUCLEAR EMULSIONS. P. G. Bizzeti and M. della Corte (Università, Florence). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVI-3-9. (In French)

An optical-electronic setup for automatic plotting of particle track thickness is described. It involves a rotating mirror, microscope, and oscilloscope. (T.R.H.)

9598

MEASUREMENT OF IONIZATION IN NUCLEAR EMULSIONS. G. Cortini (Università, Catania, Italy and Centro Siciliano di Fisica Nucleare, Catania, Italy); A. Manfredini (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome); and A. de Marco, A. Sanna, and G. Tomasini (Università, Genoa and Istituto Nazionale di Fisica Nucleare, Genoa). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVI-10-19. (In Italian)

A semi-automatic apparatus for measuring ionization in nuclear emulsions is described. The drum of an ocular filar micrometer is moved by a constant velocity synchronous motor. On the drum is a gear with 100 teeth which interrupt a light beam making pulses on a photocell. An integrator and counter measure the pulses. (T.R.H.)

9599

SEMI-AUTOMATIC APPARATUS FOR ELABORATING AND RECORDING SCATTERING MEASUREMENTS. R. Sanna (Istituto Nazionale di Fisica Nucleare, Genoa). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVI-20-9. (In Italian)

Elaboration of scattering measurements is accomplished by the use of a measurement translator associated with an ocular micrometer on a microscope and an electronic numerical computer. (T.R.H.)

9600

PRINCIPLE OF A DETECTOR WITH VERY SHORT EFFECTIVE TIME ALLOWING PHOTOGRAPHY OF THE TRAJECTORY AT IONIZING PARTICLES IN A GAS. G. Charpak (Laboratoire de Synthèse Atomique, Ivry, France). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVII-11-15. (In French)

The problem of an ionizing particle moving in a gas with an electric field is considered, and conclusions are reached regarding response times of detectors versus filler-gas parameters. It was found that an amplification factor of 10^9 corresponded with the detection limit. Experiments with a 1:10 propane–argon filling and polished Al electrodes are described and discussed. (T.R.H.)

9601

AN AUTORADIOGRAPHIC METHOD FOR DETERMINING THE DISTRIBUTION OF IRON ON RECORDING TAPE. S. M. Makin and A. E. Nunley (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 7, 123-5(1959) Dec.

Autoradiography was found to be a suitable method of measuring the distribution of iron in the magnetic coating on recording tape. Non-uniformity was found on a macroscopic and microscopic scale. Autoradiographs taken with Fe^{55} and Fe^{59} revealed irregularities over distances of 1 to 3 mm and further non-uniformity was found on 5 μ scale. (auth)

9602

A COUNTER FOR SOLID SAMPLES CONTAINING LABILE TRITIUM. A. R. G. Lang and S. G. Mason (Pulp and Paper Research Inst. of Canada, Montreal and McGill Univ., Montreal). Intern. J. Appl. Radiation and Isotopes 7, 251-7(1960) Jan. (In English)

The construction and operation of an apparatus for studying the exchange of tritium between cellulose and water by solid counting are described. It features a novel mechanism for manipulating the sample under high vacuum from a reaction chamber to a proportional counter. Counting characteristics, absorption of radiation by sample, gas and window, the time of reaction and contamination are discussed. It is believed that the device may be used in other applications. (auth)

9603

DESIGN OF HIGH SENSITIVITY SERIAL MAGNETIC RADIOSPECTROGRAPHS OF EPF-2 IKhF TYPE. A. G. Semenov (Inst. of Chemical Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 23, 1267-8 (1959) Oct. (In Russian)

A design is presented for a sensitive paramagnetic resonance spectrometer with the following specifications: wavelength, 3.2 cm; maximum sensitivity, 5×10^{-12} mole of diphenylpicrylhydrazyl; resolving power, 0.25 gauss; automatic recording, 0.5, 3, and 18 min; specimen temperature range, 196 to 200°C; feeding line, 200 v. The apparatus is practically insensitive to mechanical vibrations and environmental temperatures. (R.V.J.)

9604

NEW DATA ON DETECTION OF SLOW NEUTRONS. T. V. Timofeeva and S. P. Khormuskenko (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1283-5(1959) Nov. (In Russian)

The dependence of slow neutron counting efficiency in basic acid detectors on B^{10} enrichment was investigated. With up to 87% B^{10} and 16% boric acid, the counting efficiency of a cylindrical detector is doubled as compared to a plane-type detector; with 100% B^{10} enrichment and 34.5% boric acid the counting efficiency can be increased 2.5 fold. However, the cost of detection is considerably increased. (R.V.J.)

9605

IMAGING-FURNACE DEVELOPMENTS FOR HIGH-TEMPERATURE RESEARCH. Peter E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). J. Electrochem. Soc. 107, 226-31(1960) Mar.

The principles of imaging furnaces using the sun or a high intensity electric arc are presented. The performance of imaging furnaces with the two energy sources are contrasted and the relative advantages of each source are pointed out. Details on arc performance and construction are given. Advances in instrumentation for measuring and

controlling temperature and heat flux are described. The function of a flux distributor to obtain larger uniformly heated area is explained. (auth)

9606

MEASUREMENT OF BODY RADIOACTIVITY FOR STUDIES OF SODIUM METABOLISM. Gerald J. Hine, Paul I. Jagger, and Belton A. Burrows (Boston Veterans Administration Hospital; Massachusetts Memorial Hospitals, Boston; and Boston Univ.). J. Lab. Clin. Med. 55, 476-85(1960) Mar.

A sensitive external gamma-ray counter is described for clinical tracer studies of radioisotopes which do not concentrate specifically in any part of the human body. The detector is a 4 by 4 inch sodium iodide crystal, enclosed in a 5-inch-thick steel shield. The background counting rate, gamma-ray counting efficiency, and photopeak efficiency of the body radioactivity counter are discussed, and values are given for the 1.28-Mev gamma rays of Na^{22}. In a long-term Na^{22} study of a normal subject, the body radioactivity counter measurements proved to be more accurate in following Na^{22} retention in the body than the standard method of measurement of Na^{22} excretion in urine, in that they accounted for both renal and extrarenal losses. The exchangeable sodium could be determined from the body radioactivity counter measurements and serum specific activities at any time, with better than 3 per cent accuracy. The exchangeable sodium was found to vary with sodium intake. (auth)

9607

DIRECT METHOD FOR DETERMINING THE VELOCITY OF NUCLEAR PARTICLES. B. F. Hampton (Imperial Coll., London). J. Sci. Instr. 36, 56-60(1960) Feb.

A new method of directly determining the velocity of nuclear particles in a cloud chamber is described. It is not necessary to know the mass or charge of the particle, and measurements of radius of curvature are not involved. The principle is to make the cloud chamber in the form of a resonant microwave cavity, the electric field in the cavity being very close to breakdown. Under these conditions additional ionization takes place when the electric field is a maximum, i.e., twice per cycle, resulting in a track that is modulated in intensity. With an applied field of 3000 Mc the time marks are spaced at intervals of 2.7 mm for an α-particle having an energy of 5.6×10^6 ev. The apparatus is described, and a method of feeding 85% of the output of a magnetron into a resonant cavity is given. A certain amount of success was obtained using hydrogen as the working gas. Limitations of the apparatus are discussed and further improvements suggested. (auth)

9608

PUMPING EFFECT OF A GAS DISCHARGE HIGH-VACUUM PUMP. Libor Pátý (Charles' Univ., Prague). Nature 185, 674-5(1960) Mar. 5.

The design and properties are discussed of a high-vacuum pump with high pumping speed of from 3,000 to 7,000 liters per second, based on the principle of transport of ions during a discharge in a magnetic field. (C.H.)

9609

ELECTRONICS FOR RADIATION DETECTION. 4. MULTICHANNEL ANALYSERS. F. H. Wells (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 5, No. 46, 123-7(1960) Feb.

The electronic problem of studying nuclear events with a wide range of energy levels and the accuracy required in pulse sorting circuits are discussed. The design principles of instruments for pulse amplitude recording are considered. These include multichannel amplitude discriminators, and recorders using pulse amplitude to digital sorting circuits. The more complex instruments for pulse time recording and their use in measuring neutron energy by time-of-flight methods are discussed. The use of magnetic tape in multispectrum recorders and the applications of time-to-amplitude converters to measurement of high neutron energies are described. (auth)

9610

THERMOLUMINESCENT DOSIMETER HAS STORAGE STABILITY, LINEARITY. J. H. Schulman, R. J. Ginther, R. D. Kirk, and H. S. Goulart (U. S. Naval Research Lab., Washington, D. C.). Nucleonics 18, No. 3, 92; 95-6; 98; 100; 102(1960) Mar.

Increased sensitivity, decreased storage effect, and good dose-indication stability are provided by CaF_2: Mn dosimeters. The phosphor is coated on a graphite square, which is provided with electrical leads and sealed into an evacuated housing with a glass window. Dose determination is made in 30 sec by heating the graphite electrically and observing the glow with a photomultiplier tube. This design can detect 2.5 mr of Co^{60} gamma radiation, and doses up to at least 10,000 r are measurable with the same device. The "pickup" of spurious glow has also been reduced by this arrangement. Stability of the dose indication is good, doses of 100 mr and 10 r both reading 90% of their initial value after overnight storage and then losing 1% per day for the next 12 days. (auth)

9611

BETA BACKSCATTER MEASURES ALTITUDE. Nucleonics 18, No. 3, 124(1960) Mar.

A density altimeter is described which makes use of the beta particles from low-energy emitters like C^{14} and Pm^{147}. The density of the particles backscattered by the surrounding air is correlated to the altitude. This altimeter is being designed for use above 25,000 ft, while the pressure altimeter is used at lower altitudes. (B.O.G.)

9612

BALANCED IONIZATION CHAMBERS OFFER SENSITIVE GAS ANALYSIS. L. E. Maley (Mine Safety Appliances Co., Pittsburgh). Nucleonics 18, No. 3, 126; 128(1960) Mar.

Contaminants in gases can be detected in the parts-per-billion range by making them into smoke particles and passing them into an ionization chamber. These particles reduce ion current by acting as recombination centers. Into half of a stream a particle-forming agent is introduced; the particles increase recombination in one ionization chamber containing a source of alpha particles. The other half of the stream goes through a second chamber. The difference in the conductance of the portions is recognized as a measure of the contaminant. Measurements of contaminants were made for the following: nickel carbonyl, 0 to 100 ppb; hydrogen chloride, 0 to 50 ppb; hydrogen fluoride, 0 to 5 ppm; sulfur dioxide, 0 to 5 ppm; and carbon tetrachloride, 0 to 5 ppm in air. (B.O.G.)

9613

THE RKVT-1200 HIGH-TEMPERATURE X RAY CAMERA. V. V. Zubenko, S. S. Kvitka, and M. M. Umanskii (Lomonosov Moscow State Univ.). Soviet Phys.–Cryst. 4, 222-5(1960) Feb.

A description is given of an x-ray camera for use with polycrystalline materials up to 1200°C. Diffraction angles of 6 to 84° are covered. Temperature of the water-cooled camera can be stabilized to 0.1°C. (C.J.G.)

9614

AN X RAY DIFFRACTION CAMERA FOR USE AT LOW

AND HIGH TEMPERATURES. A. K. Shevelev and L. M. Balakina (Lobachevskii Gorky State Univ., USSR). Soviet Phys.–Cryst. 4, 225-7(1960) Feb.

A description is given of an x-ray diffraction camera which can produce two-sided patterns from polycrystalline materials at −196 to 600°C. (C.J.G.)

9615

ON THE DECOMPOSITION OF QUENCHING GAS IN G-M COUNTERS. Teh-ping Li and Shih-hua Kiu. Wu Li Hsüeh Pao 14, 136-8(1958). (In Chinese)

Measurements of the pressure rise in G-M counters filled with argon and alcohol indicate that, corresponding to each ion pair produced in the discharge, the increase in number of gaseous molecules due to alcohol decomposition lies between 5 and 10. This number increases as the overvoltage is lowered. This demonstrates that the counting life of a counter can not be expressed merely in terms of quantity of electric charge passing through it. Some possible explanations are discussed. (Sci. Abstr. China; Mathematical and Phys. Sci. No. 1, 1958, abstract No. 55.)

9616

CONTINUOUS THICKNESS MEASUREMENT USING RADIATION IN ROLLING. Hans Hart. Z. Metallk. 51, 120-31(1960) Feb. (In German)

The principles and operation of thickness measurement of rolling material by radiation are described. It is shown, how this method is realized in industry equipment. (auth)

9617

INSTRUMENTATION FOR ANALYSIS OF THE MESOSTRUCTURE OF THE WIND. G. Fea and D. Fedele (Servizio Meteorologico dell'Aeronautica Militare, [Rome]). p.93-104 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

An electronic set-up for treatment of anemometer data is described which is designed for investigation of the intermediate structure of atmospheric motion. Three anemometers with two sets of vanes, one horizontal and one vertical, are arranged at the apices of a right triangle about 1 km apart. Photo-transistors send data signals to a central station where they are combined and analyzed. (T.R.H.)

9618

TELEMETRY OF RADIOACTIVITY BY AN ELECTRONUCLEAR CENTER. Marcello Pagliari (Societa Elettronucleare Nazionale, [Italy]). p.209-18 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

The problems in measurement of radioactivity in the area around a nuclear plant and transmission of the data to a central source are discussed. (T.R.H.)

9619

HEALTH PHYSICS INSTRUMENTATION. R. G. Davis (Ekco Electronics Ltd., Southend-on-Sea, Eng.). p. 233-48 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Practical problems associated with the measurement of permissible levels of radioactivity are considered as to both internal (ingested) and external sources. The recommendations of the ICRP are given as amended in 1956 for each type of radiation and each type of exposure, and the various types of radiometric instruments are evaluated in each case. (T.R.H.)

9620

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR THE MANIPULATION OF RADIOACTIVE MATERIALS. Paul Vogel. British Patent 825,645. Dec. 16, 1959.

A hand-grip manually operated remote manipulator is described. (T.R.H.)

9621

IMPROVEMENTS IN OR RELATING TO NEUTRON GENERATORS. (to Philips Electrical Industries Ltd.). British Patent 828,600. Feb. 17, 1960.

A neutron source with a better yield over a longer period of time is described. A tube in which T and D ions are accelerated at a Au-plated target with T and D adsorbed on it is described. The T and D ions come from heating a Zr helix on which T and D are adsorbed. (T.R.H.)

9622

A DEVICE FOR ASCERTAINING NUCLEAR INDUCTION SPECTRA BY THE RESONANCE METHOD. (to Trüb, Täuber & Co. AG). British Patent 828,984. Feb. 24, 1960.

An NMR spectrometer arrangement is described. A homogeneous magnetic field of fixed direction (H_0) is imposed on a test specimen and is perpendicular to an alternating magnetic field (H_1). The axis of the receiver coil is perpendicular to H_0 and H_1. The voltage in the receiver coil is measured by 4 transmitter coils arranged so that the system has three mutually perpendicular planes of symmetry. These transmitter coils are rotatable as a unit about an axis parallel to H_0 and relative to the receiver coil. These coils are excited so that two symmetrical magnetic circuits result. The device has an improved resolving power. (T.R.H.)

Materials Testing

9623 AECU-4722

Syracuse Univ., N. Y. Metallurgical Research Labs.

AN ANALYSIS OF SEVERAL OF THE VARIABLES ENCOUNTERED IN LOW CYCLE FATIGUE. Interim Technical Report No. 4. W. W. Gerberich. June 1959. 45p. Contract AT(30-1)-2141. (MET575-594IT4). OTS.

A method of representing stress cycling is reviewed and a precise definition of terms in strain cycling is developed so that similar representation becomes physically significant. A critical evaluation of a log-log representation of the log E − log N curve for metals is examined, and the effect of the mean strain on the low-cycle fatigue life is presented. These studies were made for use in analysis of pressure vessel and gun tube materials. Data are included. (J.R.D.)

9624 MTA-1

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

BI-METAL BOND INSPECTION BY ULTRASONICS. D. E. Lord. Sept. 1952. Decl. Feb. 4, 1960. 16p. Contract AT(11-1)-74. OTS.

Design of an ultrasonic echo-type apparatus for detection and location of flaws in three-dimensional coördinates is described. The equipment exhibits good flaw sensitivity, thin section resolution, and ability to locate flaws accurately. (J.R.D.)

9625 WAL-TR-112/87-7

Watertown Arsenal Lab., Mass.

THE LOW-BLOW TRANSITION TEMPERATURE; SUM-

MARY TECHNICAL REPORT. George M. Orner and Carl E. Hartbower. Jan. 1959. 16p. DA Project No. 5B93-32-002. (AD-209775).

A method for testing Charpy impact specimens was developed which permits a separation of the crack initiation and crack propagation stages of the fracture process. The technique requires "initiation" of a crack by means of a low-energy blow and propagation of the crack by a full-capacity blow of the impact-machine pendulum. The transition temperature so obtained was demonstrated to be independent of specimen size, notch geometry, and other test variables; thus being considered a material property. The low-blow transition temperature is believed to be the maximum temperature at which an initiating crack can become self-propagating in a thick plate (where the energy required to produce shear lips is small compared with the elastic energy available for crack propagation). (auth)

9626

THE PRECISION OF THE DETERMINATION USING RADIOISOTOPES OF THE VELOCITY OF DESCENT OF A BALL IN A VISCOUS MEDIUM. Al. Popescu and I. Carabogdan. Acad. rep. populare Romîne, Inst. energet. Studii cercetări energet. 9, 623-8(1959). (In Rumanian).

A description is given of two installations for measurement of the velocity of a falling ball in viscous media using radioisotopes. The probable errors and possible applications of the two methods are pointed out. (tr-auth)

9627

THE USE OF IRRADIATED EXTRACTION REPLICAS TO IDENTIFY INCLUSIONS AND PRECIPITATES IN METALS: A PRELIMINARY NOTE. S. M. Makin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 7, 258-9(1960) Jan. (In English)

A method is described for using radioisotopes to identify specific components of material present in precipitates and inclusions in metals. A particular component is made radioactive and is then added to the melt. A specimen is cast and prepared for metallographic examination. Autoradiographs taken at this stage are then compared with micrographs. (C.H.)

9628

CONTROL OF TIGHTNESS BY LIQUATION OF HELIUM. C. Levei de Curnieu (Compagnie Française Thomson-Houston, Paris). p.197-212 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

A method for leak-testing clad fuel elements is described. The clad rod is immersed in compressed or liquid He which enters between clad and fuel through leaks. After thorough washing to remove He from the surface, the fuel element is placed in a vacuum chamber where the He which entered through leaks comes out and is detected mass spectrographically. The adaptation of this method to an industrial level and equipment and installations for performing the tests are discussed. (T.R.H.)

9629

TESTING OF METALLIC VESSELS FOR CONTAINMENT OF RADIOACTIVE GAS IN CASE OF REACTOR ACCIDENTS. F. R. Belot and M. Melice (Bureau d'Etudes Nucleaires, [Brussels]). p.213-42 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

Containment vessel purposes are pointed out and the BR-2 and BR-3 vessels are described. Inspection and testing methods to control the mechanical stability and leak-tightness of a containment vessel are discussed. The various methods used in BR-2 and BR-3 are described and evaluated in some detail. (T.R.H.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

9630 AECU-4656

Michigan. Univ., Ann Arbor. Coll. of Engineering. AN AERODYNAMIC RAINDROP SORTER. Technical Progress Report No. 1. A. Nelson Dingle and Fred V. Brock. Jan. 1960. 45p. UMRI Project 2921. Contract AT(11-1)-739. (UMRI-2921-1-P). OTS.

A pilot model of an Aerodynamic Raindrop Sorter was constructed along the lines suggested by mathematical analysis. The function of the analyzer is to sort natural rain according to drop size and to collect the sorted drops for further analysis. The pilot model, a small wind tunnel inclined at 45° to the horizontal, demonstrated the feasibility of aerodynamic rain drop sorting over a wide range of drop sizes. (auth)

9631 CEA-1173

France. Commissariat à l'Énergie Atomique, Paris. CONTRIBUTION A LA GÉOCHIMIE DE L'URANIUM DANS LES GRANITES INTRUSIFS. (Contribution to Uranium Geochemistry in Intrusive Granites). René Coulomb. Jan. 29, 1959. 84p.

Thesis submitted to Univ. of Paris.

The position is defined of a certain number of French granitic deposits within the field of the geochemistry of granites in general, and of the geochemistry of uranium in particular. The regions concerned are the French hercynian ranges, in the Vendée, in Brittany and in the Morvan, and the African range, probably precambrian, of the Hoggar. For each range the petrochemical framework is first of all determined and then the degree of chemical homogeneity of the rocks is evaluated. In the petrochemical groups thus obtained the geochemical behavior of the uranium is studied. From the viewpoint of the geochemistry of the granites under investigation, a comparison of the laws of distribution of the major elements in the ranges shows up a convergence of average composition which was not anticipated by geological and petrographic considerations alone. The statistical and geochemical distribution laws of the total uranium as a function of the petrochemical variations are established. A study of the chemical forms of uranium in the rocks has drawn an attention to the qualitative and quantitative importance of the fraction of this uranium soluble in dilute acids. The laws of distribution of the insoluble uranium, which represents essentially the uranium fixed in crystalline structures (zircon, allanite...), and the interest presented by the soluble uranium are discussed. This, although more complex in character, presents a geochemical unity in postmagmatic phenomena which makes it possible to find a genetic connection between the uraniferous deposits and the intrusive massifs. Finally, a plan of the geochemical cycle of uranium is given in which is hoped to provide some more accurate data on the igneous phase. (auth)

9632 SCL-T-295

THE DIFFERENCE IN THE PERIODS OF SEISMIC WAVES

EXCITED DURING UNDERGROUND EXPLOSIONS AND EARTHQUAKES. (Razlichie v Periodakh Seismicheskikh Voln, Vozbuzhdaemykh pri Podzemnykh Vzryvakh i Zemletriaseniiakh). S. D. Kogan, I. P. Pasechnik, and D. D. Sultanov. Translated by Marcel I. Weinreich (Sandia Corp.) from Doklady Akad. Nauk S.S.S.R. 129, 1283-6 (1959). 8p. JCL or LC.

The difference in the periods of seismic waves excited during underground explosions and earthquakes was investigated. The period of the surface waves of an explosion at epicentral distances between 300 and 1100 km was found to be 2 ± 0.5 sec. For this case, the period was practically independent of distance. At distances of 200 km, the period of the surface wave during explosions was found to be generally one-half the period of the surface waves during earthquakes; at distances of 1000 km, the period was only one-fourth; and at distances of 2000 km, the period was only one-fifth. (C.J.G.)

9633

MEASUREMENT OF ARTIFICIAL RADIOACTIVITY IN RAINWATER AT GULMARG. Lekh Vir Sud and P. S. Gill (Polytechnic Inst., Iasi, Rumania). Bul. inst. politeh. Iasi (N.S.) 4, No. 3-4, 127-8(1958). (In English)

Measurements on the artificial radioactivity of rain water collected on various days of 1956 to 1958 at Gulmarg are reported. (C.J.G.)

9634

PRIMARY MINERALIZATION OF URANIUM-BEARING "SILICEOUS REEF" VEINS IN THE BOULDER BATHOLITH, MONTANA. PART I. THE HOST ROCKS. Harold D. Wright and Barrie H. Bieler (Pennsylvania State Univ., University Park). Econ. Geol. 55, 56-72(1960) Jan.-Feb.

Between 1952 and 1956 a study was made of some of the uranium-bearing hydrothermal veins in the northern part of the Boulder batholith, Montana. Three mines, the W. Wilson, G. Washington, and Free Enterprise, were investigated in detail. The veins are characterized by a microcrystalline quartz gangue containing sparsely scattered, very fine-grained sulfide minerals and uraninite. Above the present water table, secondary uranium minerals are abundant locally. Throughout the area the veins—called "siliceous reefs"—strike east to northeast, are of steep dip, and vary in thickness from a fraction of an inch to several feet. The country rock is granodiorite containing, in order of abundance, plagioclase (An_{30} to An_{36}), quartz, orthoclase, biotite, and hornblende, with apatite, zircon, and sphene. Small bodies of aplite, pegmatite, and alaskite occur along some veins. The granodiorite adjacent to the veins is rather strongly altered. The alteration is similar throughout all of the deposits studied, in barren and ore-bearing portions alike. The essential minerals show a characteristic sequence of alteration, in the order hornblende, andesine, biotite, orthoclase, and quartz. Successive zones of alteration are characterized, from the vein outward, by maximum development of sericite (muscovite polytype 1M, in part), kaolinite, and montmorillonite. Other alteration products are quartz, pyrite, calcite, leucoxene, and chlorite. The alteration resulted in an increase in silica and ferric iron, a decrease in alumina, total iron, ferrous iron, lime, soda, and magnesia, and little change in potash, titania, phosphorus, carbon dioxide, and sulfur. Consideration of the stability fields of the sheet structure silicate minerals indicates little basis for interpretation of the temperatures prevailing during mineralization. (auth)

9635

SULFUR ISOTOPES AND ORE DEPOSITS. Wayne U. Ault and J. Laurence Kulp (Lamont Geological Observatory, Palisades, N. Y.). Econ. Geol. 55, 73-100(1960) Jan.-Feb.

A geochemical history of the sulfur isotopes in the crust of the earth is presented. New measurements of the S^{32}/S^{34} ratio on sulfide minerals are used to show that transport and depositional processes do not appear to produce appreciable variation in the relative abundance of the sulfur isotopes. The average S^{32}/S^{34} ratio in an ore deposit as well as the range of values provides information on the ultimate source of the ore-forming fluids and to some extent the mechanism of emplacement. Galenas containing lead of normal isotopic composition generally have a narrow range of S^{32}/S^{34} ratio, whereas anomalous leads carry sulfur of highly variable composition. The S^{32}/S^{34} ratios in coexisting galena and barite can be used to estimate the temperature of formation of an ore deposition but criteria of equilibrium are difficult to establish.

9636

DETRITAL-APPEARING URANINITE GRAINS IN THE SHINARUMP MEMBER OF THE CHINLE FORMATION IN NORTHERN ARIZONA. Richard G. Petersen (U. S. Geological Survey, Boston). Econ. Geol. 55, 138-49(1960) Jan.-Feb.

A sample of uranium-bearing conglomerate from the Shinarump member of the Chinle formation in northern Arizona was disaggregated in an ultrasonic separator. The sample, weighing 187 grams, contained about 60 grains of uraninite (from 0.1 to 1 mm diameter) which have the sphericity and polish suggestive of detrital grains. The detrital-appearing grains are associated with abundant interstitial uraninite, sphalerite, and pyrite, which presents conflicting evidence as to the origin of the uranium deposit. No definite conclusions are presented for the occurrence of these grains. However, the evidence strongly suggests that they are probably not detrital in origin, but are uraninite replacements of detrital grains; the original mineral may have been quartz. (auth)

9637

NATURAL OCCURRENCE OF THE SHORT-LIVED BARIUM AND STRONTIUM ISOTOPES. H. R. Heydegger and P. K. Kuroda (Univ. of Arkansas, Fayetteville). J. Inorg. & Nuclear Chem. 12, 12-17(1959) Dec.

The equilibrium ratio of Ba^{140} to U^{238} in non-irradiated uranium salts with both the natural isotopic ratio and a depletion in U^{235} was determined. The ratio, expressed in terms of 10^{-4} disintegrations per sec per g of U^{238}, is 6.2 ± 0.7. The results from natural and depleted uranium salts were found to agree within the experimental error. If Segrè's value of the spontaneous fission half-life of U^{238}, $(8.04 \pm 0.3) \times 10^{15}$ years, is taken to be correct, the spontaneous fission yield of Ba^{140} from U^{238} is found to be 9.6 ± 1.2 per cent. (auth)

9638

TRACING OF WATER FLOW BY MEANS OF RADIOACTIVE ISOTOPES AND SCINTILLATION COUNTERS. D. E. Hull (California Research Corp., Richmond). Intern. J. Appl. Radiation and Isotopes 7, 260(1960) Jan. (In English)

Advantages of using Geiger counters in tracing water flow by means of radioisotopes are discussed. (C.H.)

9639

POTASSIUM–ARGON AND RUBIDIUM–STRONTIUM AGES OF SOME GRANITES FROM BRITAIN AND EIRE. J. L. Kulp, L. E. Long, and C. E. Giffin (Lamont Geological Observatory, Palisades, N. Y.); A. A. Mills, R. StJ. Lambert, and B. J. Giletti (University Museum, Oxford); and R. K.

Webster (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature 185, 495-7(1960) Feb. 20.

New data are presented on the age of granites from various locations in Britain and Eire. The data were obtained by means of isotopic age determination techniques for measuring potassium-argon and rubidium-strontium ratios. The isotope dilution technique, using enriched Ar^{38}, was used for all argon determinations. Methods are described and results are tabulated. (C.H.)

9640

FACTORS AFFECTING THE RADIOACTIVE GAS EMANATION OF ARTIFICIALLY PREPARED SALTS AND MINERALS. I. E. Starik and O. S. Melikova. Radiokhimiya 1, 196-203(1959). (In Russian)

If a source of radon isotopes is adsorbed on the surface of an artificially prepared crystal, the radioactive gas emanation does not depend on the size of the crystal, although emanation is proportional to the specific surface on cocrystallization of radium with an isomorphous salt. The radioactive gas emanation of minerals depends only slightly on a change in specific surface. An increase of radioactive gas emanation as a function of mesh size depends on preservation of the mineral sample and maintenance of the conditions of distribution of radium in the sample. As a rule, the evolution of thoron from uranium minerals differs from that of radon and actinon, while in thorium minerals, the evolution of actinon, and sometimes that of radon, differs from that of thoron. An explanation of this behavior is very essential in age determinations from the lead isotope content. The anomalous behavior of actinon may have disrupted the ratios of AcX and Ra in the minerals. (R.V.J.)

9641

DETERMINATION OF ACTINIUM IN NATURAL MINERALS FROM ITS Fr^{223} DAUGHTER. A. K. Lavrukhina, V. Kourzhim, and L. V. Filatova. Radiokhimiya 1, 204-7 (1959). (In Russian)

Actinium may be rapidly extracted from uranium minerals by contacting a benzene solution of thiophenecarbonyl trifluoroacetone (TTA) and an aqueous solution at pH 3.5 to 5. The amount of francium in the actinium was found to be only 12 to 15% of the equilibrium amount. Actinium is apparently adsorbed by the sludge which is insoluble in concentrated nitric acid. (R.V.J.)

9642

ISOTOPIC COMPOSITION AND CONTENT OF XENON IN URANIUM MINERALS. E. E. Gerling and Yu. A. Shukolyukov. Radiokhimiya 1, 212-22(1959). (In Russian)

A method of separating and determining xenon in uranium minerals was developed. The accuracy for determining 10^{-6} to 10^{-7} cm^3 of xenon by three different mass-spectroscopic procedures (relative sensitivity, pressure, and isotopic dilution) was ±10% on the average. The isotopic composition of xenon in uranium minerals showed that up to 35% of the xenon can be formed by the neutron fission of U^{235}. Some samples were tested in which neutron-induced fission was lacking, and only spontaneous fission of U^{238} had occurred. It was shown that the accepted value for the half life of the spontaneous fission of U^{238} is somewhat too high. The majority of the older minerals ($t \approx 2 \times 10^9$ years) contained 20 to 30% of the radiogenic xenon; uranium minerals with an age $t \approx 2 \times 10^8$ years have 70 to 80% xenon. Samples were found which had up to 100% of the radiogenic xenon and other minerals were found which had lost up to 99% of the xenon. Determinations of the absolute age from the xenon content are unreliable for most pitchblende ores and uraninites because of their inability to retain xenon. (R.V.J.)

9643

SEARCH FOR URANIUM. EVOLUTION OF METHODS. A. Lenoble (Commissariat à l'Énergie Atomique, Paris). Rev. ind. minérale 41, 788-99(1959) Oct. (In French)

A review is presented of the development of uranium prospection methods by the French Commissariat à l'Énergie Atomique during the last ten years. Radiometric and geochemical methods used for general prospection and then the geochemical, geophysical, and probe methods used for detailed prospection are discussed. Mining investigations to show the existence of exploitable mineralization, to define the minimum tonnage of the deposit, and to determine the structure of the deposit are considered with respect to geological control and estimation of reserves and utilization of statistical methods of evaluation. (J.S.R.)

9644

THE MINING COMPLEX OF FOREZ. THE MINE. ORE PROCESSING PLANT. CHEMICAL PLANT. M. Beulaygue (Commissariat à l'Énergie Atomique, Paris). Rev. ind. minérale 41, 801-29(1959) Oct. (In French)

A very general review is given of the uranium mining complex of Forez, including the mine itself, the ore processing plant, and the chemical plant for the preparation of uranyl nitrate. The history of the discovery is briefly reviewed and the mineral structure is discussed. The method of exploitation is described, and the future exploitation plan is discussed. The concentration of the ore is then briefly described. The flow sheets for the ore processing plant and the chemical plant are given. The organization of the mining complex is also briefly described. (J.S.R.)

9645

THE DIVISION OF CROUZILLE. MINES. DEVELOPMENT. CHEMICAL PLANT. R. Avril (Commissariat à l'Énergie Atomique, Paris). Rev. ind. minérale 41, 830-50(1959) Oct. (In French)

The discovery and exploitation of the uranium mines of the division of Crouzille are briefly reviewed, and the geology of Haute-Vienne is described. The present stage of development of each of the mines is discussed, and the future plans are indicated. The treatment of the ores, both the physical concentration and the chemical processing, is described. A flow diagram for the ore concentration is given. (J.S.R.)

9646

ELECTRONIC SORTING OF RADIOACTIVE ORES. J. Sandier (Commissariat à l'Énergie Atomique, Paris). Rev. ind. minérale 41, 851-5(1959) Oct. (In French)

The general principles on which the electronic sorting of radioactive ores are based are reviewed, and the possible causes of error are briefly discussed. The apparatus used for the ores of Bois Noirs is described. The results obtained during the first five months of operation are tabulated. Possible future developments in electronic sorting are reviewed. (J.S.R.)

9647

EXTRACTION EQUIPMENT FOR METALLIC MINES. P. Bruley (Commissariat à l'Énergie Atomique, Paris). Rev. ind. minérale 41, 889-96(1959) Oct. (In French)

The principles governing the design of equipment for the extraction of ores from French mines are discussed. The equipment used is briefly described, and the extraction machines are described in some detail. (J.S.R.)

9648

NATURAL RADIOACTIVITY OF MIAMI SOILS. David

Telfair, Robert Garrison, and Carl Smith (Earlham Coll., Richmond, Ind.). Science 131, 727-8(1960) Mar. 11.

The relation between gross gamma activity and soil depth for Miami silt loam is presented, together with a discussion of the contribution of K^{40} and the uranium and thorium series and of the effects of fall-out from bomb tests in increasing the radioactivity of a thin layer of surface soil. (auth)

9649

GEOLOGY OF THE GARO URANIUM–VANADIUM COPPER DEPOSIT, PARK COUNTY, COLORADO. Veri R. Wilmarth. U. S. Geol. Survey Bull. 1087-A. 1959. 23p., 5 illus. (GPO).

The Garo deposit, near Garo in the west-central part of Park County, Colo., was mined for radium in 1919 and for uranium, vanadium, and copper in 1951 and 1952. The ore minerals that constitute the deposit are in three complexly faulted sandstone beds of the Maroon formation of Pennsylvanian and Permian age, on the northeast flank of the northwest-trending Garo anticline. Most of the ore that has been mined came from the youngest sandstone bed (bed 1), but some ore has been produced from the oldest sandstone bed (bed 3). The ore bodies are small and lenticular and apparently are confined to the more permeable parts of the sandstone beds adjacent to minor subsidiary faults. Sedimentary structures may have aided in localizing the ore bodies. Channel samples from the ore bodies in bed 1 contain as much as 0.48 percent uranium and 1.37 percent V_2O_5, whereas samples from sandstone bed 3 contains as much as 0.062 percent uranium and 0.49 percent V_2O_5. Copper has been produced from sandstone bed 1. Within the ore bodies the ore minerals—tyuyamunite, metatyuyamunite, volborthite, carnotite, covellite, chalcocite, azurite, and malachite—occur in fissure veins and as disseminated grains between the detrital grains in the sandstone. The dominant gangue minerals are calcite, hematite, and chalcedony. The original minerals—chalcocite, covellite, pyrite, and possibly uraninite and montroseite—have been oxidized and only small remnants of the primary sulfide minerals were observed in the ore. Oxidation of the primary uranium and vanadium minerals resulted in the formation of tyuyamunite, metatyuyamunite, volborthite, and carnotite and small quantities of uranophane and calciovolborthite. The intersection of faults which cut the rocks of the Maroon formation should be used as a guide in prospecting for uranium in the vicinity of Garo. (auth)

9650

URANIUM RESOURCES OF THE GREEN RIVER AND HENRY MOUNTAINS DISTRICTS, UTAH. A REGIONAL SYNTHESIS. Henry S. Johnson, Jr. U. S. Geol. Survey Bull. 1087-C. 1959. 49p., 4 illus. $1.00(GPO).

The results of an appraisal of the geologic relations of the U resources of the Green River and Henry Mountains districts in parts of Grand, Emery, Wayne, San Juan, Garfield, and Kane Counties, Utah, are presented. The history, general geology, and U occurrences of the Green River and Henry Mountains districts are briefly reviewed, and an attempt is made to appraise the relative favorability of potentially ore-bearing geologic formations for significant U deposits. Expected deposit size, depth to ore, ore controls, and major controlling factors of favorable ground are also discussed. (W.L.H.)

9651

EVALUATION OF THE LEAD-ALPHA (LARSEN) METHOD FOR DETERMINING AGES OF IGNEOUS ROCKS. David Gottfried, Howard W. Jaffe, and Frank E. Senftle. U. S. Geol. Survey Bull. 1097-A. 1959. 66p. $0.35(GPO).

The method and techniques are described in detail that have been used to obtain the lead-alpha activity ratios on the suitable radioactive accessory minerals, to compare the calculated ages with the geologic sequence of events and with ages obtained by other physical methods, to evaluate the assumptions involved, and to point out the applicability and the limitations of the method. (W.L.H.)

9652

THE PHOSPHORIA, PARK CITY AND SHEDHORN FORMATIONS IN THE WESTERN PHOSPHATE FIELD. V. E. McKelvey. U. S. Geol. Survey Profess. Papers, 313-A. 1959. 51p., 3 illus. $1.00(GPO).

The Phosphoria formation of Permian age consists mainly of chert, carbonaceous mudstone, and phosphorite at the type locality in southeastern Idaho. These rocks intertongue with and pass laterally into a dominantly sandy sequence in southcentral Montana and northwestern Wyoming and into a dominantly carbonatic sequence in west-central Wyoming and northeastern Utah, although thin tongues of phosphatic and cherty rocks persist over all these areas. The carbonatic sequence in turn intertongues with and passes laterally into greenish-gray and red beds in eastern Wyoming and southeastern Montana, eastern Utah, and northwestern Colorado. The plan of nomenclature developed to describe these rocks and their relationships has the following as its chief elements: (1) it retains the name "Phosphoria formation" for the chert-mudstone-phosphorite facies and identifies as tongues of the Phosphoria formation rocks of these lithologies that interfinger with sandstone and carbonate rock along the fringe of the phosphate field; (2) it retains the name "Park City formation" (Permian) for the sequence of carbonate rock in Utah, restores this name for similar carbonate rock in west-central Wyoming, and identifies as tongues of the Park City formation beds of carbonate rock that interfinger with other formations in Idaho, western Wyoming, and Montana; and (3) it introduces the new name "Shedhorn sandstone" for sandstone of Phosphoria age in northwestern Wyoming and adjacent parts of Montana, and identifies as tongues of the Shedhorn the beds of sandstone that interfinger with the Phosphoria and Park City formations in northwestern Wyoming and southwestern Montana.

9653

GEOPHYSICAL FIELD INVESTIGATIONS. REGIONAL GEOPHYSICAL INVESTIGATIONS OF THE LISBON VALLEY AREA, UTAH AND COLORADO. P. Edward Byerly and H. R. Joesting. U. S. Geol. Survey Profess. Papers 316-C, 39-50(1959). GPO.

Aeromagnetic and gravity surveys have been conducted in the Lisbon Valley area as part of a study of the regional geology of the Colorado Plateau. The Lisbon Valley area is located in the Paradox Basin in the east-central part of the Colorado Plateau. As here defined it includes the southern three-quarters of the Mount Peale, Utah and Colorado, 30-minute quadrangle. Exposed rocks range in age from Pennsylvanian to Quaternary, and include, in the northern part of the area, the intrusive rocks of the La Sal Mountains of probable Tertiary age. The Pennsylvanian section includes limestones and clastic rocks, whereas the overlying Permian and younger sedimentary rocks are mainly sandstone, siltstone, and shale. Evaporites of Pennsylvanian age have been penetrated in a well in the Lisbon Valley area. Older rocks of Pennsylvanian, Mississippian, Devonian, and Cambrian (?) age have been penetrated in

wells drilled in adjoining areas, and probably are present in the Lisbon Valley area. The major structure is the Lisbon Valley faulted salt anticline, with its accompanying negative gravity anomaly of about 15 milligals. This structure differs from most of the other large salt anticlines of the Paradox Basin, in that the evaporites do not intrude the overlying rocks. A piercement salt plug, north of the Lisbon Valley anticline, and local thickening of salt in the western and northwestern parts of the area are also indicated by gravity anomalies. The alinement of late Paleozoic salt intrusions with the South Mountain group of igneous intrusions in the La Sal Mountains indicates that this group was intruded along a zone of previous structural activity. The magnetic anomalies are caused mainly by variations in the magnetization of the basement rocks. Basement structural trends, as indicated by magnetic trends, coincide in part with surface structure and are divergent in part. A prominent basement ridge or platform in the southwestern part of the area, flanked by a basin to the northeast, is indicated by the magnetic data. (auth)

9654
PRELIMINARY GEOLOGIC MAP OF THE SENTINEL PEAK NE QUADRANGLE, MONTEZUMA COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-224. E. B. Ekren and F. N. Houser. Washington, D. C., U. S. Geological Survey, 1959. $0.50(USGS).

9655
AMBIENT CHARACTERISTICS OF THE SITE CHOSEN FOR THE SORIN NUCLEAR RESEARCH CENTER AT SALUGGIA. p.33-40 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

The site chosen for SORIN Nuclear Research Center and its 1-Mw pool-type reactor is described. Geography, population, climatology, meteorology, geology, hydrology, seismology, and accessibility of the area, which is near Saluggia (Vercelli), are discussed. (T.R.H.)

9656
CONSIDERATIONS FOR VAPOR CONTAINMENT OF AN ELECTRONUCLEAR POWER PLANT. Carlo E. Rossi (FIAT. Sezione Energia Nucleare, Turin). p.243-72 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

After some general considerations in the selection of a vapor container, a discussion is presented of the criteria for a power station with a pressurized water reactor. The principal regulations applied to construction of containment vessels for American power plants are reviewed and compared to rules which should be followed for such a structure in Italy. A description is given of the acceptability tests for containers, and their principal auxiliary systems are enumerated. (T.R.H.)

9657
CRITERIA FOR EVALUATION OF A LOCALITY BASED ON A CLIMATOLOGICAL AND DEMOGRAPHIC ANALYSIS OF THE SURROUNDING REGION. Aldo Persano (Società Elettronucleare Italiana, Milan). p.31-48 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

A method for carrying out a climatological and demographic survey of a region to evaluate it for a nuclear plant site is given. The study involves four phases which are treated separately: definition of the homogeneous climatological region which influences the region studies; characterization of the climate of the region from the point of view of turbulent diffusion in the atmosphere, using available statistical data; transition from the climatology of the region to the micrometeorology of the site studied and its surroundings; and interpretation of the results of the climatological analysis with respect to the population involved. (T.R.H.)

9658
STUDY OF THE LOCAL CIRCULATION IN AN ALPINE VALLEY (VAL RENDENA) IN RELATION TO THE GENERAL METEOROLOGICAL SITUATION. Benvenuto Pavesi (Servizio Meteorologico dell'Aeronautica Militare, Rome). p.69-92 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

A detailed study of the winds of Val Rendena, Italy, is presented. (T.R.H.)

9659
STUDY OF WIND VARIATIONS FROM TWO OR MORE POINTS WITH STATISTICAL METHODS. Ezio Rosini (Servizio Meteorologico dell'Aeronautica Militare, Rome). p.131-44 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

A statistical method is described for studying winds at two places close together or from two directions. (T.R.H.)

HEALTH AND SAFETY INCLUDING DOSIMETRY

9660 AD-212845
Ford Instrument Co., Long Island City, N. Y.
FALLOUT PREDICTOR. Quarterly Report No. 2 [for] October 1, 1958 to December 31, 1958. R. E. Bailey, W. Cannon, A. J. Cassano, M. Polan, and A. Richter. Jan. 15, 1959. 79p. Contract DA-36-039-SC-78185.

A functional flow chart of a program for calculating fallout is presented. The flow chart includes the introduction of input parameters, the calculation of particle settling rates, the interpolation of winds in time and space, the calculation of horizontal displacements taking topography and rainout into account, the accumulation of the final data, and a data output. The stabilized bomb cloud dimensions can best be determined by empirical means for bomb yields greater than 10 kilotons although data is scarce for bursts above 100 kilotons yield. The dimensions of clouds from bombs of less than 10 kiloton yield are difficult to predict with accuracy. In a surface burst, most of the radioactivity is in the lower third of the mushroom cloud. The radioactivity has a Gaussian distribution when plotted against particle size. An expression for the radiation cooling effect for a 20 kiloton surface burst is derived and combined with Machta's basic relationship for determining the maximum height of a bomb cloud. Radiation of heat does not appear to significantly affect the maximum height of the bomb

cloud. The bomb cloud is displaced horizontally by winds existing at the bomb site and downwind from the bomb site for extended time periods. The time the cloud spends in each wind layer can be found from typical time versus height curves determined empirically. The cloud motion can then be calculated by using the time and wind data. A functional flowsheet is developed for calculating the settling rates of particles. Two alternatives are discussed, one using a constant height decrement, the other using a constant time decrement. (For preceding period see AD-208066.) (auth)

9661 AECU-4613

Army Veterinary Corps., Las Vegas, Nev.

OFF-SITE ANIMAL INVESTIGATION PROJECT. Second Annual Report. Garland R. Farmer. June 30, 1959. 20p. Contract AT(29-2)-162. OTS.

During the period July 1, 1958, to July 1, 1959, an experimental herd of cattle spent 126 days in the Ball Mountain Region, 16 days in the White Rock Springs Region, 16 days in the Climax Mine Region, 179 days in the Yucca Flat Region, and 28 days in the Papoose Lake Area in the vicinity of the Nevada Proving Grounds. This environment contained a full spectrum of fission product isotopes and background readings ranged from 0.5 mr/hr up to 1 r/hr. Twenty-four animals, representing both sexes and various age groups, were sacrifices. Tissues were analyzed for total fission product radioactivity and for strontium-90 content. Data are tabulated. No noticeable effects due to fission product radioactivity were observed. (C.H.)

9662 KAPL-M-HP-3

Knolls Atomic Power Lab., Schenectady, N. Y.

HEALTH PHYSICS QUARTERLY REPORT [FOR] OCTOBER–DECEMBER 1959. R. J. Feinberg, comp. Jan. 12, 1960. 20p. Contract W-31-109-Eng-52. OTS.

Routine health physics activities during the period are summarized. The annual audit of KAPL film dosimeter wearers revealed no personnel radiation exposure that was greater than the maximum permissible limits set by the National Committee on Radiation Protection and Measurements. External radiation exposure results are tabulated. Data are included on the radioactivity in environmental air samples, rainfall, ground water, and solid wastes. (For preceding period see KAPL-M-HP-2.) (C.H.)

9663 OTO-58-5

Reynolds Electrical and Engineering Co., Inc. Radiological Safety Div., Las Vegas, Nev.

ON-SITE RADIOLOGICAL SAFETY REPORT. Operation HARDTACK—PHASE II. 1958. 141p. Contract AT(29-2)-162. OTS.

Safety procedures are outlined which were used during Operation Hardtack-Phase II. This consisted of 37 nuclear test events conducted from September 12, 1958, to October 30, 1958, at the Nevada Test Site. Seven thousand six hundred fifty-two persons entered the Nevada Test Site during the operation. No exposure was received which was above the authorized maximum permissible dosage. (C.H.)

9664 SCS-TM-13

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

RADIOACTIVITY HAZARD IN ATMOSPHERE FROM THE DISSOLUTION OF MONAZITE ORE. A. P. Seyfang. 1955. 8p. (SWTC/R-121).

Information concerning the extent of airborne radioactivity arising during the dissolution of monazite in hot sulfuric acid is presented. (J.R.D.)

9665 USNRDL-TR-363

Naval Radiological Defense Lab., San Francisco.

ANALYSIS OF STANDARD-PLATFORM WIND BIAS IN FALLOUT COLLECTION AT OPERATION REDWING. H. K. Chan. Sept. 16, 1959. 51p.

At Operation REDWING, fall-out sampling was conducted by arrays or groups of similar collecting instruments. Each array was located on the periphery of an elevated circular wind-shielded platform designated as the standard platform. A correlation of the sampling variations in the amounts of fall-out collected within the platforms was accomplished by the analysis of the collection data and the platform's air-flow characteristics. With a single-wind system the amount of fall-out collected in the upwind part of the platform was lower than that collected in the downwind section and the collections around the platform varied symmetrically with respect to the wind direction. With a multi-wind system, similar characteristics were exhibited about a reference direction which was correlated to the variability of wind directions and associated fallout amounts by a vector summation. The extent of sampling variation or collection bias in both systems can be defined by certain parameters. For each platform the values of these parameters were obtained from the properties of a collection curve describing the variation around the platform. Collection curves of both systems were completed by interpolation and their notable aspect is that they resemble sine curves. At the only land station the sampling data between the platform collection and the associated collection on the ground was too limited for extrapolation to other systems. Sampling relationships between platform collection and associated ground collection are described for the single-wind system but not for the multi-wind system. At the ship stations the equivalent ground value of the platform collections, i.e., the value that would be collected by the earth's surface, could not be determined; however, the weighted mean values of some of these platform collections are presented. (auth)

9666 USNRDL-TR-368

Naval Radiological Defense Lab., San Francisco.

FALLOUT FROM HIGH EXPLOSIVE DEVICES CONTAINING U^{238}. H. K. Chan. Sept. 18, 1959. 38p.

The nature and size of fall-out particles produced by the detonation of devices containing high explosives and U^{238} were studied. Analyses showed that U^{238}, Al, Ba, and Fe were the major elements present in the four cloud samples studied; the amounts of these elements in each sample were determined. A filter paper oxidation technique and a special washing technique were employed to recover the particles from the cloud samples. Two major types of particles were collected. One type, which comprised 35 to 50% of the particles, was black, opaque, and spheroidal in shape. The other type was transparent, spherical and either colorless or brown or green in color. Radioautographic studies showed that both types emit alpha tracks; however, the black particles were much more radioactive. Examination of density-separated particle fractions indicate that the black particles were relatively rich in U^{238} while the transparent particles were rich in iron and silica. The density of the fall-out particles ranged from less than 3.7 g/cm^3 to beyond 4.2 g/cm^3. Particle size distributions of the particle samples and their black particle fractions followed a log-normal distribution. The geometric mean size of the particle samples was 7 to 15 μ while the size ranged from 9 to 17 μ for their black particle fractions. To estimate the extent of fall-out the falling trajectories of representative particle sizes of black particles

were calculated and plotted. The relative distribution of U^{235} on the ground was determined after estimating the weight distribution of U^{238} in each size fraction of black particles. From these calculations and several assumptions the fraction of U^{238} deposited per unit area was calculated. (auth)

9667 USNRDL-TR-386

Naval Radiological Defense Lab., San Francisco.
RADIOCHEMICAL ANALYSIS OF INDIVIDUAL FALLOUT PARTICLES. J. L. Mackin, P. E. Zigman, D. L. Love, D. MacDonald, and D. Sam. Sept. 17, 1958. 46p.

Quantitative measurements were made of the radioactivity of individual fall-out particles from a nuclear detonation at the Eniwetok Proving Grounds. These measurements were possible since individual particles which represented approximately 10^{10} or more fissions were obtained. Although several types of particles were observed, the data were generally resolved as being derived from two major particle classes depending upon whether the coral had undergone an obvious physical alteration such as melting. A number of individual particles was radiochemically analyzed for the nucleides Mo^{99}, Ba^{140}-La^{140}, Sr^{89}, and Np^{239}. The data obtained, together with gamma spectral and decay measurements, indicate that fractionation of radionuclides was prominent in the fall-out particles. Measured R values for Ba^{140} and Sr^{89} based on Mo^{99} were over an order of magnitude lower in the altered particles than in the more normal-appearing or unaltered particles. The fissions/gram values of altered particles averaged 100 times that of unaltered particles. Gamma decay curves of the two classes of particles taken from H + 50 to H + 10,000 hr showed marked dissimilarities. In addition to the established feasibility of the individual particle measurements it is postulated that the radioactive composition of fall-out at any point may be determined by the relative numbers of the two major classes of particles observed. (auth)

9668 USNRDL-TR-399

Naval Radiological Defense Lab., San Francisco.
A STUDY OF THE REPRODUCIBILITY OF IONIZATION READINGS OBTAINED WITH LANDSVERK MODEL L-65 200-mr POCKET CHAMBERS. B. W. Shumway, H. H. Hechter, and W. G. Miller. Jan. 4, 1960. 19p.

A study was made of the reproducibility of ionization readings obtained with Landsverk 200-mr chambers used in conjunction with modified Model L-62 charger-readers. The errors considered were the differences between radiation trials, between two charger-readers, between chambers, and between two methods of reading. These were measured at levels of exposure of 33, 100, and 167 mr. Estimates of the errors associated with the degree of exposure indicated that the variance of the readings was proportional to the scale reading. It was observed that some chambers did not maintain a given calibration though others were excellent. The modified charger-readers were found to be interchangeable, and readings could be reproduced at full scale with an error of about 2½ per cent. A systematic error was observed when the meter of the charger-reader was set at zero prior to introducing a chamber to be read. A method of reading in which an offset from zero was made prior to introducing a chamber resulted in nearly eliminating the error. There was a variation in the readings obtained with different radiation trials. Attempts to relate this variation to any of the variables tested or with radiation trial sequence were unsuccessful. (auth)

6996 Y-1283

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
NEUTRON EXPOSURE DOSIMETRY OF HUMANS BY IN VIVO GAMMA MEASUREMENT OF SODIUM-24. R. E. Cofield. Sept. 21, 1959. 18p. Contract W-7405-eng-26. OTS.

A procedure for neutron dosimetry of humans by in vivo gamma spectrometric measurement of the sodium-24 content of the human body is described. Specific calibration of the 9-inch-diameter × 4-inch-thick NaI scintillation crystal of the Y-12 In Vivo Radioactivity Measurement Facility for body sodium-24 is included. The apparent limit of detection, at an examination rate of one subject each fifteen to twenty minutes is 2.5×10^{-3} μc sodium-24 in the body. The relationship of body sodium-24 to neutron dose is made on the basis of the 1958 Y-12 criticality accident and results in an apparent limit of detection of 12.5 millirads if the sodium-24 measurement is made within fifteen hours after neutron exposure. (auth)

9670 AEC-tr-3986

DOSIMETRY WITH IONIZATION CHAMBERS. H. H. Naumann. Translated for Los Alamos Scientific Lab. from Atompraxis 3, 362-8(1957). 13p. JCL.

The magnitudes of principal interest in radiation measurements include the amount and intensity of radiation, the total absorbed dose, and the absorbed dose rate. These magnitudes are examined, and a discussion of units for use in expression of radiation and its effects is presented. Aspects of radiation absorption are examined and factors affecting the operation of dosimeters are outlined. Descriptions of specific dosimeters are included. (J.R.D.)

9671 JPRS-L-1843-D

CURRENT PROBLEMS OF DOSIMETRY IN RADIATION THERAPY. A. N. Krongauz. Translated from Vestnik Rentgenol. i Radiol. 34, No. 3, 52-9(1959). 14p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 16733.

9672

CURRENT APPLICATIONS OF THE REVERSE-JET FILTER PRINCIPLE. Knowlton J. Caplan (Mallinckrodt Chemical Works, St. Charles, Mo.). A.M.A. Arch. Ind. Health 21, 200-8(1960) Mar.

Design features and functional performance of reverse-jet filters are described. Current applications are discussed. (C.H.)

9673

RADIATION AND INDUSTRIAL HEALTH. Charles L. Dunham (U. S. Atomic Energy Commission, Washington, D. C.). A.M.A. Arch. Ind. Health 21, 287-91(1960) Mar.

Health problems of the atomic age are reviewed. Biological effects of radiation are discussed. The training programs for radiation protection of the AEC and U. S. Public Health Service are outlined. Contributions of other organizations, such as the American Standards Association, the National Academy of Sciences, the British Medical Research Council, the American College of Radiology, and the Federal Radiation Council, to radiation protection are discussed. (C.H.)

9674

REPORT ON RECOMMENDATIONS OF THE STUDY GROUP ON THE USE OF RADIOISOTOPE TELETHERAPY UNITS AND SUPERVOLTAGE RADIATION IN RADIOTHERAPY. Acta Radiol. 53, 171-6(1960) Feb. (In English)

The Study Group, which was convened by the International Atomic Energy Agency and the World Health Organization, met in Vienna Aug. 3 to 5, 1959 and held six meetings. It was the intention of the Group to produce basic recommendations which would be of value to all

authorities who carry responsibilities for radiotherapy in the treatment of cancer; those who are considering the establishment of radiotherapy centres; practising radiotherapists; and practising radiation physicists. Recommendations are presented which were drawn up with a view to giving practical guidance and should be considered for this purpose rather than as a contribution to fundamental knowledge on this subject. In particular, it is thought that these recommendations may be of special value in those countries where radiotherapy is not yet firmly established. (auth)

9675

PROTECTIVE CLOTHING PROGRAM AT THE SAVANNAH RIVER PLANT. H. L. Butler and R. W. Van Wyck (E. I. du Pont de Nemours and Co., Aiken, S. C.). Am. Ind. Hyg. Assoc. J. 21, 55-8(1960) Feb.

A continuous program for the evaluation of protective clothing is described which has resulted in an increase in the protective value of garments and a savings which exceeds $300,000 per year. (C.H.)

9676

THE INHALATION HAZARD FROM DUST-PRODUCING OPERATIONS IN THE REPAIR OF SHIPS WITH LOW-LEVEL RADIOACTIVE CONTAMINATION. Sidney Goren and Joseph H. Thornton (U.S. Naval Air Station, Point Mugu, Calif.). Am. Ind. Hyg. Assoc. J. 21, 71-9(1960) Feb.

Results are reported from an evaluation of the hazards expected to be encountered by personnel engaged in the repair of ships having a low-level radioactive contamination. Hazards associated with disk-sanding, pneumatic wire-brushing, welding, and pneumatic chipping are considered. Respirators and other protective devices employed at present are discussed. It is concluded that there is a need for the development of a combination welding mask and respirator unit for the use of welders working on moderately contaminated surfaces. (C.H.)

9677

FACILITIES FOR HANDLING AND STORAGE OF MEDICAL RADIATION SOURCES IN A LARGE HOSPITAL UNIT. Norman A. Baily (Roswell Park Memorial Inst., Buffalo). Am. J. Roentgenol., Radium Therapy Nuclear Med. 83, 462-4(1960) Mar.

A unit for storing and incorporating radium cells into clinical applicators and needles has been described. The general approach is also applicable for cobalt-60 sources. The unit embodies economy of construction and can be built on the premises. It provides adequate protection for the work required in a busy hospital radiologic department. A comparison of calculated and measured dose rates is given. Film badge exposure records are discussed. (auth)

9678

FILM DOSIMETRY OF COBALT 60 RADIATION. Walter Mauderli, David M. Gould, and John W. Lane (Univ. of Arkansas, Little Rock). Am. J. Roentgenol., Radium Therapy Nuclear Med. 83, 520-4(1960) Mar.

When films are placed within a phantom, backscatter effects were shown to be a source of considerable error even with high energy cobalt-60 radiation. This source of error can be eliminated by removing that portion of the phantom which is behind or back of the film. Under these conditions, the response of the film and the ionization chamber correlate well. Forward scatter does not disturb the correlation except to introduce a small error in large fields. (auth)

9679

CONFIDENCE FACTORS IN THIMBLE CHAMBER DOSIMETRY. J. E. Morgan (Univ. of California, Los Angeles). Am. J. Roentgenol., Radium Therapy Nuclear Med. 83, 578-80(1960) Mar.

A method is described which, by cross references to a suitably designed radium source, permits quantitative evaluation of sensitivity changes occurring in thimble chamber instruments at any time after their initial calibration. An abbreviated formula is derived to provide compensation for such changes, and at the same time to supplant, if so desired, the correction factors usually applied for ambient atmospheric conditions. (auth)

9680

PROBLEMS ON THE IONIZING RADIATIONS MEASURING UNITS. F. Fossati (Ist. di Radiologia dell'Ospedale Maggiore, Milan). Energia nucleare (Milan) 7, 95-8(1960) Feb. (In Italian)

A short review of some problems still open in the field of the measure units of ionizing radiations is given. (auth)

9681

THE PROBLEM OF DEPTH DOSE MEASUREMENTS OF FAST ELECTRONS. W. Minder (Radium-Institut, Bern), H.-J. Maurer and C. E. Buchheim (Universität, Bern). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 92, 206-11(1960) Feb. (In German)

The problems of dose measurements of fast electrons are briefly discussed. A series of new depth dose curves in water is presented for electrons of energies between 10 and 30 Mev. The value of the curves is compared with other published sets. Chemical dose measurements carried out on liquid systems do not indicate any decrease of converted energy with increasing electron energy. The transfer of energy traceable by measurements of photographic densities under irradiation with fast electrons is caused by contribution from scatter, which is difficult to detect by conventional dose measuring methods. (auth)

9682

MEASUREMENT OF THE RADIATION DOSE TO PATIENTS IN X RAY DIAGNOSIS. E. Zieler. Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 92, 211-16(1960) Feb. (In German)

The problem of measuring the dose to patients in x-ray diagnostics is discussed. It is of special importance to take into account the particular size of field used. The methods for measuring the surface dose in $r \times cm^2$ and the integral dose in $kg \times rad$ are compared and reasons given for the choice of $r \times cm^2$ as measuring unit for the Mueller diagnostic-dose-counter. It is shown that it must be possible for some investigations to deduce the gonad dose from the measured surface dose. (auth)

9683

THE "RADIATION PROTECTION VALUE" OF THE HUMAN BODY AGAINST THE GAMMA RADIATION OF RADIUM. E. Schumann (Röntgen-und Radiuminstitut der Medizinischen Akademie, Erfurt, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 92, 216-21(1960) Feb. (In German)

The gamma radiation of radium is attenuated by the human body to a degree which one may first find surprising considering the great penetration of the radiation. On transversing an adult's trunk in an anterior-posterior direction the radiation is reduced to approximately half. This kind of attenuation is relevant for practical protection in many ways wherever radium is applied for medical purposes. When radium operations are performed one ought to make use, for example, of the protection provided by the person dealing with the patient, provided the partic-

ular stage of the operation permits to do so. Also the attenuation of the radiation through the body of a patient with a radium insertion may be made use of for protection. Thus when patients with radium insertions are transported or nursed it is advisable to approach the patient from that side which makes the largest volume of the patient's tissue to be interposed between the source and the patient's surface. The protection value of the human body against radium gamma radiation is exemplified on hand of various dosimetric situations typical of practical work with radium. To make use of this protection value apart from the usual protection arrangements (protective layers and distance) involves no extra costs. It just requires some knowledge and care and it is possible to make good use of the patient's protection value wherever radium is applied. (auth)

9684

CARBON-14 PRODUCTION FROM NUCLEAR EXPLOSIONS. Albert L. Latter and Milton S. Plesset (RAND Corp., Santa Monica, Calif. and California Inst. of Tech., Pasadena). Proc. Natl. Acad. Sci. U. S. 46, 241-7(1960) Feb.

As a result of nuclear explosions, the carbon-14 content in the stratosphere has increased to such a magnitude that it is easily detected. Practically all the neutrons released by a nuclear bomb into the atmosphere are captured by nitrogen, thus producing carbon-14. An estimate of the neutron escape efficiency is 2.5 neutrons per 200 Mev of energy released or about 0.5 moles of carbon-14 per kilotron of bomb yield. A formula is presented for calculating the yield of carbon-14 produced by any given explosion. (B.O.G.)

9685

PROBLEMS AND CRITICAL CONSIDERATIONS RELATIVE TO FILM DOSIMETRY FOR PROTECTION AGAINST IONIZING RADIATION. Bruno Bellucci (Universita, Perugia, Italy). Radiol. med. 45, 1137-52(1959) Dec. (In Italian)

The sources of error which enter into the precision of film dosimetry are considered with emphasis on two particular points which can lead to dosimetric evaluations quite remote from actuality. The first point is the variable incidence with which radiation strikes the film-badge plates. Experimental research shows that oblique or lateral incidence can cause dosimetric deviations of 100% of the value indicated by a film. The second error lies in the location of the film badge on the person of the radiologist with respect to shielding worn by him. This can cause dosimetric evaluations both higher and lower than the dose received. To remedy these errors, a correction coefficient for the value indicated by the film is proposed; this coefficient is obtained by experimental studies of dosimetry by a moving film badge compared with values obtained by a stationary badge. On the other hand two plates could be used simultaneously, one under the shielding and the other on an unprotected part of the body (anterior surface of the arm). The evaluation of the dose indicated by the two films would be accomplished by a percentage factor based on calculation of the protected and unprotected body surface to indicate the effective dose received by the body of the radiologist. Also a technique is proposed mainly for obtaining standard dosimetric films exposed by exact radiation doses (as opposed to the present autonomous film-badge technique). This new method involves simultaneous exposure of 10 films to a decreasing scale of doses obtained by application of the law of the square at distances. (tr-auth)

9686

MEASUREMENT OF RADIOACTIVITY IN PRECIPITATION. A. Sittkus. Strahlenschutz 6, 71-4(1957). (In German)

A report is made on studies of radioactivity of rain water samples from atom-bomb products. The method used in the study is described in detail and results are briefly discussed. (T.R.H.)

9687

MEASUREMENT OF RADIOACTIVITY OF DRINKING WATER. C. R. Baier. Strahlenschutz 6, 106-12(1957). (In German)

A discussion is presented on how drinking water becomes radioactively contaminated and how the radioactivity can be detected and measured. An appendix on important protective measures to be taken to avoid radioactive contamination of public water supplies is included. (T.R.H.)

9688

HEALTH PHYSICS. VOLUME 1. PROGRESS IN NUCLEAR ENERGY. SERIES XII. W. G. Marley and K. Z. Morgan, eds. New York, Pergamon Press, 1959. 622p. $15.00.

Topics covered in this book include permissible levels of exposure to ionizing radiations and radioactive materials, operational experience of radiation protection in uranium mines, atomic energy plants, and factories using radioisotopes, radiation measurements and dosimetry, radioactivity measurements in human beings, meteorological aspects of atomic energy and the evaluation of reactor accident hazards, and environmental hazards and the disposal of radioactive wastes. (C.H.)

9689

SAFETY FACTORS TO BE CONSIDERED IN REACTOR SITING. Clifford K. Beck (U. S. Atomic Energy Commission, Washington, D. C.). p.20-36 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

The difference between the routine radioactive disposal hazard and an accidental radioactivity release is pointed out. The "credible accident" concept is discussed as it is applied in the U.S.A. and present schemes for protection are described. Some semi-quantitative statements to be used as guides are given. (T.R.H.)

9690

URBANISTIC FACTORS IN THE LOCATION OF NUCLEAR INSTALLATIONS. Giulio Rusconi Clerici (Comitato Nazionale per le Ricerche Nucleari, Rome). p.41-50 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

The interaction of a nuclear installation and its surroundings has become the subject of a new field of study called nuclear urbanistics. This discipline deals with: study and selection of sites for experimental and power producing installations; control of the organization and size of nuclear centers; and effects of the center on the surroundings. These three aspects are discussed in detail. (T.R.H.)

9691

SOME OBSERVATIONS UPON THE INFLUENCE ON PUBLIC SAFETY OF UNDERGROUND CONTAINMENT IN NUCLEAR POWER PLANTS. Jakob Kägi (Sulzer Bros., Ltd., Winterthur, Switzerland). p.67-86 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

General reactor siting problems are surveyed, and a comparison is made between above ground and underground nuclear power stations as to public safety. Fundamental layout possibilities for underground reactor plants are explored, and price comparisons are made. (T.R.H.)

9692

RESEARCH ON CONTAINMENT FEATURE OF CAVERN FOR UNDERGROUND LOCATION OF REACTORS. Teo Leardini (Società Adriatica di Eletricità, Venice). p.87-102 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Some considerations are given on particular problems arising from the underground location of nuclear power plants and in the site selection for the project of a nuclear power station to be located in Veneto—a North Eastern District of Italy. A new method for the evaluation of the containment characteristics of a cavern is dealt with. Reference is made to experimental research on a semi scale which has been carried out to test the containment effectiveness of caverns lined with different types of finishing techniques, and its thermal behavior. Conclusions are drawn with reference to the best technique of cavern finishing for an underground plant located in limestone rock mountains. (auth)

9693

ADMINISTRATIVE PROCEDURES FOR ENSURING NUCLEAR SAFETY IN A RESEARCH ESTABLISHMENT. C. M. Nicholls (United Kingdom Atomic Energy Authority, Harwell, [Berks, Eng.]). p.439-52 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

The administrative precautions taken to minimize accidents at Harwell are described. The areas in which administration was actively involved included design and operation, for which applicable safety principles are given. These principles involve the definition of responsibility for nuclear safety, the writing of a safety hazards report, and independent scrutiny of the report. The Harwell Criticality Clearance Committee and its functioning are described. (T.R.H.)

9694

ON THE METEOROLOGICAL TREATMENT OF SITE SELECTION OF ATOMIC POWER PLANTS IN SWEDEN. Bengt Samuelsson (Swedish State Power Board, Stockholm). p.19-30 of " VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Meteorological investigation conducted in connection with nuclear reactor plant site selection in Sweden is discussed. Local studies, made at appropriately placed towers, include temperature, moisture, wind speed, and wind direction at various heights. A wind gustiness instrument provided data for computation of Sutton's diffusion parameters. Topographic considerations involved are also discussed. (T.R.H.)

9695

METEOROLOGY OF A TYPICAL ALPINE VALLEY AS RELATED TO SITE SELECTION FOR A NUCLEAR POWER PLANT. Monteraldo Schiavon (Società Adriatica di Elettricità, Venice). p.49-68 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

The role of meteorology in power reactor site selection is pointed out both for normal operation and accidents, and a study of atmospheric diffusion over broken terrain is described. A typical valley in the Pre-Alps of Veneto was chosen, described, and instrumented. The processing and analysis of data are also described. (T.R.H.)

9696

THE EFFECTS OF METEOROLOGICAL FACTORS ON THE DISPERSION OF AIRBORNE MATERIAL. P. J. Meade (Meteorological Office, London). p.106-30 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

A brief description is given of the meteorological processes involved in the transport by the wind of airborne material discharged continuously from a fixed source. Methods of estimating probable concentrations at varying distances downwind from the source are described. The basic parameters are the lateral and vertical spread of the cloud, and complicating effects such as sedimentation by diffusion and washout by rain are ignored. The meteorological variables that need to be measured are discussed. Finally, suggestions are made on the interpretation, in the light of meteorological data, of the results of surveys made on the distribution of concentrations in the area surrounding a source of pollution. (auth)

9697

DIFFUSION OF GASEOUS EFFLUENT FROM A NUCLEAR POWER REACTOR. Carlo Tribuno and Luciano Bramati (AGIP Nucleare, Milan). p.145-54 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

A list is given of the gaseous effluents actual or expected from power reactors such as AGIP Nucleare or NPPC. The source of the radioactive gas or smoke and the type of hazard associated with each are given and discussed. Some calculations of diffusion rates are included. (T.R.H.)

9698

EXAMPLE OF AN ORGANIZATION FOR METEOROLOGICAL MEASUREMENTS AT A NUCLEAR PLANT (ISPRA). Luigi Santomauro (Centro Nucleare, Ispra, [Italy]). p.155-76 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

The meteorological installation and organization of the Centro di Studi Nucleari di Ispra, Italy are described and discussed with respect to the factors entering in the design. The main features of the system are a meteorological observatory, tower, conventional meteorological station, a track-mounted station, and a mobile station. The observation and recording program is outlined. (T.R.H.)

9699

NATIONAL MONITORING OF RADIOACTIVE POLLUTION OF THE ATMOSPHERE. G. Fea (Servizio Meteorologico dell'Aeronautica Militare, [Rome]). p.199-208 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti

Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

A national weather and radioactivity data collecting and transmitting network is discussed. Some ideas on arrangements and techniques are given. (T.R.H.)

9700

EXTERNAL VENTILATION DUCTS OF THE NUCLEAR REACTOR AT ISPRA. Eliodoro Pomar (Comitato Nazionale per le Ricerche Nucleari, [Rome]). p.219-32 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

Calculations in connection with construction of a concrete external ventilation conduit for the Ispra Reactor I are given. (T.R.H.)

9701

SITE CHOICE CONSIDERED IN RELATION TO PROBLEMS OF RADIOACTIVE EFFLUENT DISPOSAL. Francis Duhamel (Commissariat à l'Énergie Atomique, Paris). p.251-64 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

The parameters on which a nuclear plant site choice depends are discussed, and the hazards involved, continual and accidental, are outlined. It is concluded that the problem should be considered both in its psychological and financial aspects, and that more practical experience and scientific data are needed. (T.R.H.)

9702

WATER TREATMENT AND SAFETY IN NUCLEAR INSTALLATIONS. Benoît de La Morinerie (SERATOM, France). p.413-30 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

The importance of treatment of water at nuclear sites is discussed with emphasis on radioactivation and disposal. Activation in the primary and secondary loops is described, and personnel access to regions of activity from radioactive water, and disposal of such radioactivated water are included in the discussion. (T.R.H.)

9703

FINANCIAL PROTECTION WITH RELATION TO AMBIENT CONDITIONS. Bruno De Mori (Pool Italiano per l'Assicurazione dei Rischi Atomici, Italy). p.451-8 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

The hazards involved in location of nuclear plants are discussed briefly in relation to insurance and financial considerations. (T.R.H.)

ISOTOPE SEPARTION

9704 CEA-tr-R-778

UTILISATION DES CARBONYLES POUR LA SÉPARATION DES RADIOISOTOPES ^{51}Cr, ^{99}Mo, ^{187}W, ^{99m}Tc, et ^{188}Re. (Use of Carbonyls for Separation of Radioisotopes Cr^{51}, Mo^{99}, W^{187}, Tc^{99m}, and Re^{188}). W. (V.) D. Nefedov and M. A. Toropova. Translated into French from Zhur. Neorg. Khim. 3, 175-80(1958). 22p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13840.

9705

SWEDISH HEAVY WATER PROCESS. 2. B. J. Eriksson (Allmanna Svenska Elektriska A.B., Sweden). Chem. & Process Eng. 41, 53-7(1960) Feb.

A description is given of a pilot plant for the production of heavy water by the Swedish process (dual-temperature isotope exchange between hydrogen sulfide and water). The optimum design of a full-scale plant is considered and the economics involved are discussed. (C.J.G.)

9706

HEAVY WATER PRODUCTION IN THE USA. V. R. Thayer (E. I. du Pont de Nemours & Co., Wilmington, Del.). Nuclear Power 5, No. 46, 108-11(1960) Feb.

Heavy water production by the hydrogen sulfide–water dual temperature exchange process (GS process) is discussed relative to the apparatus employed, principles of the process, flow control, the heat exchange system, and economics of the process. (C.J.G.)

9707

REACTORS FOR FIRST ORDER EQUILIBRIUM REACTIONS. APPLICATION TO ISOTOPIC EXCHANGE REACTIONS. R. Montarnal, O. Bloch, and J. C. Balaceanu (Institut Français du Pétrole [Paris]) and G. Dirian (Commissariat à l'Énergie Atomique, Paris). Rev. inst. franç. pétrole et Ann. combustibles liquides 14, 678-95(1959) Apr.-May. (In French)

Isotopic exchange reactions of the type $A + B' \rightleftharpoons A' + B$ where A′ and B′ refer to the concentrations of rare isotopes, such as $H_2O + HD \rightleftharpoons HDO + H_2$, are equilibrium reactions in which the kinetics often follow a rate equation of the form $V = k(y - y_e)$, where y represents the mole fraction of the species B′ and y_e this quantity at equilibrium. In the case where A and B belong to different phases, the methods of calculation for reactors operating with uniform concentrations and with concentration gradients, in counter-current and parallel current cascades, have been established and the respective advantages of the various systems examined. This leads to equations analogous to those used in the calculation of extraction columns, and the graphical methods of solution are similar. However, the rate constant of the chemical reaction, a fundamental quantity obtained by classical kinetic experiment, which takes the place in the calculations of the empirical efficiency of an extraction stage, here enables the exact number of reactors to be obtained with great precision. The conditions of validity of such a calculation have been established experimentally for the catalytic water deuterium exchange in liquid phase over a wide field. This calculation can be extended to many other exchange reactions of the same type. For the case where the exchange is governed both by a chemical reaction and by diffusion phenomena, the calculation is more complex and is not dealt with. (auth)

MATHEMATICS AND COMPUTERS

9708 UCRL-9054

California. Univ., Berkeley. Lawrence Radiation Lab. OPTICAL ANALOG FOR A SYMMETRIC QUADRUPOLE. Jonathan D. Young. Jan. 22, 1960. 22p. Contract W-7405-eng-48. OTS.

The construction of an optical analog to a symmetric quadrupole by use of an IBM 650 computer program is described. (auth)

9709

PERCENTAGE POINTS FOR THE DISTRIBUTION OF OUTGOING QUALITY. G. P. Steck and D. B. Owen (Sandia Corp., Albuquerque, N. Mex.). J. Am. Statist. Assoc., 54, 689-94(1959) Sept.

The random nature of the average outgoing quality of a finite number of lots was investigated and its distribution examined. Approximate percentage points for the distribution of outgoing quality for a finite number of lots are given. (C.J.G.)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

9710 AD-217234

General Electric Co. Electronics Lab., Syracuse, N. Y.
A STUDY OF THERMOELECTRIC GENERATOR MATERIALS. Interim Report No. 1 [for] May 13, 1958 to March 1, 1959. N. Schwartz and W. J. van der Grinten. 48p. Contract DA-30-115-ORD-960.

Investigations of parameters which determine the efficiency of the direct conversion of heat to electrical energy are reported. The design of an experimental program for synthesis of improved materials resulting from the parameter study is also described. Results of materials investigations are given, and the Thermion-Seebeck converter is described. An experimental program designed to yield high-temperature thermal conductivity data for use in thermoelectric conversion is also outlined. (J.R.D.)

9711 AECU-4714

Syracuse Univ., N. Y. Metallurgical Research Labs.
INVESTIGATION OF THE PROBLEM OF FRACTURE PRODUCED IN VARIOUS ALLOYS BY PLASTIC STRAIN CYCLING AT AMBIENT AND ELEVATED TEMPERATURE. Research Renewal Proposal. George Sachs. [1960?]. 24p. Contract AT(30-1)-2141. (METGS-230559). OTS.

A proposal to investigate the failure of alloys due to thermal shock and fatigue and due to combined fatigue and creep failure occurring in a relatively small number of cycles is presented. This investigation is related to a present program aimed at understanding the problem of fatigue failures in reactor pressure vessel components. (J.R.D.)

9712 BAW-1089

Babcock and Wilcox Co. Research Center, Alliance, Ohio.
LIQUID METAL FUEL REACTOR EXPERIMENT. CAVITATION BY BISMUTH. F. L. Hovanec. Dec. 1959. 46p. Contract AT(30-1)-1940. OTS.

Croloy 2¼ was tested to determine the causes and effects of cavitation in dynamic liquid bismuth solutions. Velocity and static pressure were of primary concern although some attention was given to viscosity, metallurgical treatment, surface finish, and corrosion inhibitors. The results indicate: cavitation damage increases with velocity; metal damage decreases with increased static pressure; there is a correlation between oxidation and cavitation but the relationship is not clear; corrosion inhibitors reduce cavitation damage, suggesting that cavitation entails concurrent chemical-mechanical attacks; and cavitation attacks show no preference for a particular heat treatment or weld process. (auth)

9713 BLG-35

Brussels. Centre d'Etude de l'Energie Nucléaire.
PREPARATION D'ALLIAGES URANIUM–NIOBIUM PAR REDUCTION EN BOMBE. (Preparation of Uranium–Niobium Alloys by Bomb Reduction). J. J. Huet and H. Massaux. Mar. 13, 1959. 24p.

Uranium–niobium alloys were prepared by direct reduction with calcium of uranium tetrafluoride and niobium pentoxide. The reduction of potassium oxyfluoniobate did not give satisfactory results. Alloys containing up to 20% niobium have been successfully achieved. Ternary alloys containing chromium and vanadium have been prepared by simultaneous reduction of chromium anhydride and vanadium pentoxide. The preparation of the alloys is described and the results are discussed. (auth)

9714 BMI-1405

Battelle Memorial Inst., Columbus, Ohio.
BEHAVIOR OF RUBBING MOLYBDENUM SURFACES IN SODIUM ENVIRONMENTS. John W. Kissel, Carl W. Melton, and William A. Glaeser. Jan. 4, 1960. 25p. Contract W-7405-eng-92. OTS.

A study has been made of the wear and friction phenomena associated with sliding molybdenum surfaces lubricated by liquid sodium. Operating conditions included sodium temperatures from 250 to 1300°F, sliding speeds of from 0.22 to 2.5 mm per sec, and contact stresses of 80,000 psi. Sliding specimens consisted of a ball and a flat rectangle. Sodium was found to influence the sliding behavior of molybdenum by modifying reacted films which provided boundary lubrication. These effects were also found to be temperature dependent. Addition of clean sodium between dry rubbing molybdenum surfaces in an argon atmosphere of high purity produced a marked drop in friction coefficient, and the character of the wear scar changed from galling to superficial scratching. Furthermore, these effects persisted after removal of sodium by evaporation. Studies of the films formed on molybdenum surfaces during sliding in liquid sodium and under controlled atmospheres were carried out using electron and x-ray diffraction, electron microscope, and differential thermal-analysis techniques. It was established that a sodium molybdate film on the molybdenum surfaces can be associated with low friction and diminished surface damage. Studies in vacuums up to 10^{-6} mm of mercury showed that native oxides on molybdenum also influence its sliding behavior. (auth)

9715 NDA-2116-5

Nuclear Development Corp. of America, White Plains, N. Y.
SPONGE FUEL EVALUATION. Quarterly Technical Report for the Period Ending December 31, 1959. J. M. McKee. Feb. 15, 1960. 9p. Contract AT(30-1)-2303. OTS.

Capsules designed to test two sizes of uranium shot (unalloyed, 3% enriched) are scheduled at MTR for burnup to 1.25 at.% at 1100 to 1400°F. Incomplete sodium infiltration of packed uranium shot was eliminated by vacuum outgassing the uranium at 100°F prior to use and by raising the infiltration temperature to 750°F. Satisfactory all-niobium contained fuel specimens were produced indicating that no basic material incompatibilities are involved in the design. (J.R.D.)

9716 NP-8380

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS, DECEMBER 1, AND 15, 1959. M. J. Wahll, comp. 78p.

A collection of 124 abstracts of technical papers on Ti, Be, B, Mo, Ta, W, steels, stainless steel, nickel and cobalt alloys, nonmetallic refractories, and coatings is given. (C.J.G.)

9717 ORO-250
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
MONTHLY LETTER REPORT NO. 13 COVERING THE PERIOD FROM NOVEMBER 15 TO DECEMBER 15, 1959. J. D. Fleming. Dec. 28, 1959. 2p. Project No. B-153. Contract AT(40-1)-2483. OTS.

An apparatus is described for ring tensile testing of ceramics. Fabrication studies and the determination of the elevated temperature tensile strength of slip-cast silica are discussed. The feasibility of fabricating very thin samples of silica is considered. (W.D.M.)

9718 ORO-255
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
MONTHLY LETTER REPORT NO. 15 COVERING THE PERIOD FROM JANUARY 15 TO FEBRUARY 15, 1960. J. D. Fleming. Feb. 19, 1960. 2p. Project No. B-153. Contract AT(40-1)-2483. OTS.

The influence of neutron irradiation on the strength of slip-cast fused silica was investigated. The preparation of Be-UO_2 thermets is reported. Investigations of graphite mold release suspensions were continued. (W.L.H.)

9719 WADC-TR-58-452(Pt. II)
New York. State Univ. Coll. of Ceramics, Alfred:
METAL FIBER REINFORCED CERAMICS. Period covered: September 1, 1958 to August 31, 1959. J. J. Swica, W. R. Hoskyns, B. R. Goss, J. H. Connor, and J. R. Tinklepaugh. Aug. 24, 1959. 49p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-5298. OTS.

The principal geometric variables involved in ceramic-refractory metal fiber composites were evaluated using thermal shock resistance as the most important criteria. Several different ceramic-metal fiber composites were investigated. Using the alumina-molybdenum and alumina-mullite-molybdenum fiber systems, the comparative properties of the two basic types of composites were demonstrated. Composites were developed which had flexural strengths exceeding 30,000 psi following four thermal shock cycles. (auth)

9720 WAPD-BT-16(p.156-96)
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
EVALUATION OF MATERIALS FOR STEAM GENERATOR TUBING. D. E. White. 41p.

An investigation has been conducted at Bettis to find an alternate material for austenitic stainless steel which would be suitable for use in pressurized water reactor plant steam generators and which would not be subject to chloride stress corrosion cracking. After a preliminary evaluation of materials, the field of investigation was narrowed to certain ferritic steels, austenitic steels, and nickel-base alloys and commercially pure titanium. Extensive testing on these selected materials showed Inconel to be the most promising alternate to type 347 stainless steel for steam generator tubing. (auth)

9721 WASH-124
Division of Research, AEC.
URANIUM ALLOY NEWSLETTER NO. 3. David W. Lillie, ed. May 27, 1953. Decl. Oct. 7, 1959. 44p. OTS.

Argonne National Lab. The fabrication and thermal cycling of U-Zr alloys are reported. The effect on corrosion rates of surface roughness from acid etching of U-Zr alloys was investigated. Battelle Memorial Inst. Quantitative data were obtained on solubility limits in the U-Zr system at temperatures of 685, 690, and 705°C. Heat treatment of U-Zr alloys and kinetics of transformation of low-melting U alloys are discussed. The role of C as an effective alloying element for increasing dimensional stability of α-rolled and α-annealed U was investigated. Corrosion data are summarized for an arc-melted U-Zr alloy series exposed to boiling water for periods ranging from 20 to 24 weeks. The corrosion of U alloys, having 5 and 12 at.% additions of Cr, Co, Fe, Mn, and Ni, exposed to boiling water, is tabulated. Two creep tests on Hanford β-treated U rods were made for 1800 hr at 500°C. Density measurements are given for arc-melted U-Zr alloys. Knolls Atomic Power Lab. Preparation and thermal cycling of C-U alloys, heat treatment and radiation effects on Cr-U alloys, and the corrosion of U-Zr alloys are briefly discussed. Massachusetts Inst. of Tech. Preparation, density, and hardness measurements and dimensional stability of Cr-U and Fe-U alloys are reported. Thermal expansion vs. temperature curves of Cr-U and Fe-U alloys are tabulated. National Bureau of Standards. Microscopic studies of the as-cast Ag-U alloys in the composition range 0 to 50 wt.% U were made. New York Operations Office. Status of the work at the Feed Materials Production Center (National Lead Co.), Mallinckrodt Chemical Works, and Savannah River are briefly stated. Sylvania Electric Products Inc. Results of thermal cycling cold-pressed and sintered U alloys are tabulated. Westinghouse Atomic Power Div. A study is presented on the effects of Mo and Nb additions on the corrosion resistance of U alloys. (W.L.H.)

9722 WASH-126
Division of Research, AEC.
URANIUM ALLOY NEWSLETTER NO. 5. David W. Lillie, ed. Nov. 1953. Decl. Feb. 16, 1960. 35p. OTS.

Argonne National Laboratory. Work on U–Zr alloys included thermal cycling in Zr and stainless steel jackets, examination of irradiated specimens, and analysis of castings. A Nb–U alloy was examined microscopically in relation to its corrosion behavior after various heat treatments. The fabrication of U–Nb alloys is discussed. Various corrosion tests on H_2O-quenched U–Nb and U–Zr–Nb alloys in distilled H_2O are after various annealing treatments, in 100°C H_2O are reported. Armour Research Foundation. Corrosion rates of U-base alloys, as-cast and after various annealing treatments, in 100°C H_2O are tabulated. Battelle Memorial Institute. Work on the U–Zr phase diagram continued. The thermal and dilational changes during high-speed heating of the eutectic U–Cr alloy and effect of small ternary additions on the melting point of the U–5 wt.% Cr eutectic alloy were studied. Deformation of U–C alloys cycled 500 times from 100 to 500°C is discussed. Corrosion data are given for a U–Zr alloy series exposed to boiling H_2O. The effect of high-temperature H_2O on arc-melted and induction-melted alloys is discussed. The tensile properties of α-annealed (24 hr at 575°C) binary U–Zr alloy at room temperature and 700°F and of the U–Cr alloy at room temperature and 500°C are given. The casting of U–Zr ingots is discussed. Knolls Atomic Power Laboratory. The effects of C content on the grain structure of U–C alloys are described. Equipment designed to study the kinetics of solid state transformations in U and its alloys by measurement of electrical resistivity changes is discussed. Massachusetts Institute of Technology. Data on dimensional stability of thermal-cycled α-extruded U are given. Possible container materials for molten U–Cr alloys are discussed. Oak Ridge National Laboratory. Results of U creep and stress-rupture tests are reported briefly. Sylvania Elec-

tric Products Inc. Preparation of U–Mo alloys by cold-pressing and sintering, and preparation of the U–Bi alloy by hot-pressing techniques were studied. Corrosion rates of Nb–U alloys in 100°C water are given. Westinghouse Atomic Power Division. Corrosion lives of U alloys in 650°F water are tabulated. Phase studies on U–Mo alloys and corrosion of clad U–Mo alloys are discussed. (D.E.B.)

9723 WASH-153

Division of Research, AEC.

URANIUM ALLOYS NEWSLETTER NO. 6. David W. Lillie, ed. Feb. 5, 1954. Decl. Nov. 30, 1959. 61p. OTS.

Ames Lab. A study was made of the Mg-U system and the solubility of U in Mg at various temperatures. Results of producing a corrosion-resistant diffusion coat on U by dipping in a Mg bath saturated with a metal such as Ni, Si, Zr, etc., are reported. Phase studies of Nb-U alloys, corrosion resistance of U alloys, casting U into metal cans, and corrosion of Ta and other refractory metals by U-rich liquid alloys are reported. Argonne National Lab. Microstructure of U-Zr alloys and phase diagrams of U-Zr, Nb-U, and Nb-U-Zr alloys were studied. Armour Research Foundation. The determination of the corrosion resistance of U-base alloys is briefly reported. Battelle Memorial Inst. Phase diagrams of U-Zr alloys, transformation kinetics and thermal cycling of Cr-U eutectic alloys and Mo-U alloys, and grain size, hardness, and corrosion resistance of U alloys were investigated. Tests were made to develop suitable techniques for casting of Cu-U alloy samples for irradiation in the MTR. Hanford Works. Irradiation tests were made to determine the effect of Cr on the dimensional stability of Cr-U alloys. Knolls Atomic Power Lab. Tests were made on the effects of radiation on Cr-U alloys and on heat treatment of U-Zr alloys. Massachusetts Inst. of Tech. The results of thermal cycling tests on extruded graphite-melted U-Zr alloys are tabulated. National Bureau of Standards. A study of the structure of Au-U alloys is briefly presented. North American Aviation Inc. Experimental data to estimate the peak operating temperature of unalloyed U metal slugs are reported. Sylvania Electric Products Inc. Cold-pressed and sintered binary alloys containing about 1 wt.% Mo or 1.6 wt.% Nb were made of high density and fine grain size. The effects of thermal cycling hot-pressed powder metallurgy alloy for 500 cycles between 100 and 500°C and 468 cycles between 200 and 700°C and corrosion of powder metallurgy U alloys in 100°C water are tabulated. Westinghouse Atomic Power Lab. Corrosion data for Nb-U and Nb-U-Zr alloys and comparative results for Mo-U alloys as a function of water testing temperature are presented. (W.L.H.)

9724 WASH-154(Del.)

Division of Research, AEC.

URANIUM ALLOY NEWSLETTER NO. 7. David W. Lillie, ed. May 1954. Decl. with deletions Dec. 1, 1959. 61p. OTS.

Ames Lab. The liquidus for the Zn-rich end of the U–Zn system and etching of U by ionic bombardment were studied. The solubility of Ag in U and Cr–U eutectic, effect of aging temperature upon hardness and electrode potentials of quenched Nb–U–Zr alloys, and the corrosion of Ta by liquid Cr–U alloys are reported. Argonne National Lab. Preparation and purification of U–Zr alloys and radiation effects and phase studies for these alloys are presented. Work on the constitution of C–U system, fabrication, effects of radiation, and corrosion of Nb–U alloys, and the effect of high-temperature aging on corrosion resistance of Nb–Sn–U alloys are reviewed. The method of fabrication of Nb–U–Zr alloys is described. The effect of Nb on the corrosion of U–Zr alloys and effect of Si on the corrosion of Nb–U–Zr alloys are tabulated. Armour Research Foundation. A study was made of the isothermal transformation characteristics of Mo–U alloys. Battelle Memorial Inst. Electrical resistivity and temperature coefficients of resistivity of U alloys are tabulated. Corrosive behavior in 100°C water was determined for some binary U alloys. High-speed dilation data for U–Zr alloys are given. Hanford Atomic Power Operation. U–Zr alloys for a production test to determine the effects of alloying element upon the dimensional stability of U were evaluated. Zr analysis of γ-forged, α-rolled, and crystallized U–Zr alloy rods and the Rockwell D hardness of U–Zr alloys are tabulated. Effects of radiation on Cr–U and Mo–U alloys are reported. Knolls Atomic Power Lab. Effects of radiation on C–U system, heat treatment of U–Zr alloys, and the crystal structure of the ϵ phase in U–Zr alloys were studied. Massachusetts Inst. of Tech. The effect of cladding on thermal cycling behavior of U–Zr alloys is briefly outlined. National Bureau of Standards. A brief report is presented on Au–U and Pt–U systems, and the alloying characteristics of U are briefly discussed. North American Aviation, Inc. Tabulation of the results of thermal cycling of U alloys is given. Sylvania Electric Products, Inc. Work was done on ternary and the more complicated U alloy systems based on the additions of Nb, Si, Cr, Mo, and Zr. Thermal cycling and corrosion data are reported. Westinghouse Atomic Power Div. The hydride explanation of discontinuous failure, continuation of phase diagram, and transformation rate studies of U–Mo alloys are discussed, and alloy development is outlined. (W.L.H.)

9725 WASH-155

Division of Research, AEC.

URANIUM ALLOY NEWSLETTER NO. 8. David W. Lillie, ed. Aug. 1954. Decl. Oct. 7, 1959. 66p. OTS.

The etching of uranium by ionic bombardment showed grain boundaries and a variety of twin markings. Investigations were designed to evaluate the corrosion resistance of quenched Nb–U–Zr alloys in 300°C distilled water. Small amounts of Sn were found to decrease corrosion resistance of Nb–U alloy, and all data indicate that H is the active material causing the discontinuous failure of samples. The identification of phases present in Mo–U alloys using an x-ray diffraction spectrometer is reported. Aging data were obtained for U alloys containing 45 to 59 wt.% Zr as part of an investigation of the region. Work on the transformation kinetics of metastable γ in the 30 at.% Mo alloy continued. Data on the tensile properties of U and high-U alloys containing Zr and Cr are tabulated. A survey was made of the corrosion behavior in hot water of binary U alloys containing additions of 42 elements. High-speed dilation measurements were made on U–Zr alloy during thermal cycling. Investigation of the recrystallization of Al–U alloys after cold working and the effect of cold working on the strength and hardness is reported. Preparation, radiation effects, and heat treatment of some U–Zr alloys are briefly discussed. Low binary alloys of U were produced by coreduction. Dilute alloys of U with Si, Cr, and Ti were produced. Investigations of the properties of Au–U, Pt–U, Pd–U, and Ru–U alloys are reported. Data on the thermal cycling of powder-compacted U alloys are tabulated. A review of the work on the preparation of Si–U, Mo–U, and U–Zr alloys and the corrosion of U–Zr and Nb–Zr alloys in boiling water is presented. Phase diagram studies, isothermal decomposition, and hydride formation of U–Mo alloys are reported. Clad U alloys and corrosion of U alloys were investigated. The MTR Process water irradiation of clad Mo–U alloys is discussed. (W.L.H.)

9726 AEC-tr-3983

A NEW COMMERCIAL ALUMINIUM FOR BRIGHTENING. Rich. Lattey. Translated for Los Alamos Scientific Lab. from Ind.-Anz. 81, 18(1959). 3p. JCL.

Development of a type of Al which can be electropolished and retain its finish after anodic oxidation is described. Various additives are discussed and it is pointed out that "Erftal" containing small quantities of Cu, Zn, Si, Fe, and Mg is very adaptable to other phases of the process, while producing a highly reflective surface. (J.R.D.)

9727

HIGH TEMPERATURE VACUUM EQUIPMENT FOR TREATMENT OF REACTIVE AND REFRACTORY METALS. A. L. Feild, Jr. and V. A. Peckham, Jr. (Universal-Cyclops Steel Corp., [Bridgeville, Penna.]). ASTM Bull. No. 244, 34-9(1960) Feb.

Equipment design considerations for the elevated-temperature treatment of reactive and refractory metals in a high-vacuum environment are discussed, and present limitations of several types of research and development equipment are reviewed. New designs for a vacuum hot hardness tester, vacuum quenching furnace, and vacuum tension test furnace are presented. These units are capable of operation to 3000°, 4000°, and 3000°F respectively, and provisions can be made to extend further the upper temperature limit. The design features of an operable inert atmosphere rolling mill for processing refractory metals without contamination at temperatures to 3500°F are revealed. (auth)

9728

X-RAY STUDIES OF DEFORMED METALS. B. E. Warren. Progr. in Metal Phys. 8, 147-202(1959).

Experimental techniques and data on x-ray-diffraction studies of cold-worked metals are reviewed. The effects of small coherent domains and strains upon the powder pattern of a material are discussed. Experimental techniques for studying cold-worked metals are discussed, and the Fourier series methods for evaluating the data are given. The effects of faulting on the powder patterns of face-centered cubic, hexagonal close-packed, and body-centered cubic metals are discussed. The experimental results from x-ray studies by various investigators on the above types of metals are compared. The powder pattern power theorem is presented. (C.J.G.)

9729

SOME PROBLEMS IN ELECTRON THEORY OF METALS. I. THE CLASSIC AND QUANTUM MECHANICS OF ELECTRONS IN METALS. I. M. Lifshits and M. L. Koganov. Uspekhi Fiz. Nauk 69, 419-58(1959) Nov. (In Russian)

A review is given of the following: classical and quantum mechanics of electron conductivity; the statistical thermodynamics of an electron gas, where thermal and magnetic properties of the metal in a state of equilibrium are analyzed; and investigations of kinetic phenomena, particularly galvano-magnetic and resonance phenomena. The data presented are based on the works of theoretical physicists of Khar'kov Univ. (R.V.J.)

Corrosion

9730 AECU-4742

[Los Alamos Scientific Lab., N. Mex.].

ELECTRON DIFFRACTION STUDY OF THE REMOVAL AND FORMATION IN VACUO OF OXIDE FILMS ON URANIUM AND PLUTONIUM. James T. Waber, Clayton Olsen, and Dawn D. Whyte. 1959. 29p. Contract [W-7405-eng-36]. OTS.

Experiments and the development of apparatus relating to the preparation of an oxide-free surface on uranium are described. Polishing the metal in vacua of the order of 10^{-7} mm Hg was found to be the most successful method. UH_3 and UO_2 were observed to form rapidly on the metal in such a vacuum. PuO_2 was found to form on plutonium in vacua at pressures less than one micron. The sequence of oxide film formation on uranium when both the dioxide and monoxide are present revealed the sequence: dioxide/monoxide/uranium. (auth)

9731 CEA-1407

France. Commissariat à l'Énergie Atomique, Paris.

OXYDATION D'ACIERS ORDINAIRES OU ALLIÉS CHAUFFÉS DANS LE GAZ CARBONIQUE SOUS PRESSION. (Oxidation of Ordinary Steel or Alloys Heated in Carbon Dioxide Under Pressure). D. Leclercq, C. Chevilliard, and R. Darras. 1960. 43p.

Selection tests were carried out on commercial steels from the viewpoint of their resistance to oxidation in carbon dioxide, under 25 atmospheres pressure, between 350 and 600°C. Comparative curves of oxidation kinetics were obtained, from which the influence of various additive elements can be found. Small amounts of aluminum particularly seem to be favorable in the case of only slightly alloyed steels. (auth)

9732 DP-429

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

CORROSION OF STAINLESS STEEL IN THOREX PROCESS SOLUTIONS. Patricia M. Kranzlein. Dec. 1959. 15p. Contract AT(07-2)-1. OTS.

The corrosion of 304L and 309SCb stainless steel was studied in $HF-HNO_3$ solutions proposed for the Thorex process. Except for the dissolving and waste evaporation steps in the Thorex process, corrosion of 304L and 309SCb is not expected to exceed that experienced in the Purex process. To minimize the high initial corrosion rate of 309SCb in the boiling $HF-HNO_3$ dissolving solution, a heel of thorium should be maintained in the dissolver. The corrosion rate of 304L in the low activity waste evaporator can be reduced by adding one mole of aluminum per mole of fluoride to the evaporator feed. (auth)

9733 HW-23022

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SHORT TIME CORROSION TESTS OF BRONZE, MILD STEEL, T-304 STAINLESS STEEL AND 2S ALUMINUM IN 10% POTASSIUM TETRABORATE SOLUTION. Y. B. Katayama. Dec. 14, 1951. Decl. Jan. 4, 1960. 4p. OTS.

The relative corrosion rates of aluminum, stainless steel, bronze, and mild steel in 10% potassium tetraborate solution were determined. Data are tabulated. (J.R.D.)

9734 HW-23494(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE FORMATION OF CHEMICAL FILM DEPOSITS ON ALUMINUM SURFACES. R. V. Andrews. Feb. 8, 1952. 199p. OTS.

An investigation to establish rates of chemical film deposition on aluminum surfaces from water was conducted. Data on the effects of temperature, water velocity, and type of aluminum on the rate of film formation are given. (J.R.D.

9735 HW-61851

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A REVIEW OF URANIUM OXIDATION. A. J. Scott. July 15, 1959. 13p. Contract AT(45-1)-1350. OTS.

A literature search was conducted on uranium oxidation studies relative to basic reactor design and operating criteria, corrosion and pyrophoricity control during metal processing and storage, and reactor hazards estimation. (C.J.G.)

9736 LA-1929

Los Alamos Scientific Lab., N. Mex.

OXIDATION OF METALS SUBJECTED TO A LINEAR TEMPERATURE INCREASE: CUBIC AND LOGARITHMIC LAWS. James T. Waber. July 1955. 12p. Contract W-7405-eng-36. OTS.

The total amount of oxidation which occurs up to a given time when a metal is subjected to a continuously increasing temperature has been studied by Fassell and coworkers. A constant rate of increase as well as the linear and parabolic oxidation laws were assumed. The present report extends the analysis to include the cubic and logarithmic growth laws. The notation for the nth order exponential integral functions which is used here simplifies the equations and the calculations. The rate of the heterogeneous surface reaction has been assumed to be proportional to the surface coverage of adsorbed molecules, and this in turn is related to the effective gas concentration (P/RT) by Langmuir's adsorption isotherm. It is not known, however, whether this assumption is compatible with the mechanisms which lead to the cubic or logarithmic oxidation growth laws. Two limiting cases of this isotherm are considered—namely that (1) the rate is directly proportional to the gas concentration, and (2) the rate is independent of the gas concentration. These limits lead to simpler equations. (auth)

9737 NAA-SR-4386

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE LARGE COMPONENT TEST LOOP. H. Strahl. Mar. 1, 1960. 19p. Contract AT-11-1-GEN-8. OTS.

A large-scale loop complex for proof testing reactor components in sodium under simulated reactor operating conditions has been constructed. The system is capable of circulating sodium at variable flow rates to 1200 gpm with temperatures up to 1000°F. Thermal-shock tests may be conducted to simulate reactor scram conditions with temperature differences up to 500°F. (auth)

9738 NASA-TN-D-222

National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

AN INVESTIGATION OF THE ROLE OF GASEOUS DIFFUSION IN THE OXIDATION OF A METAL FORMING A VOLATILE OXIDE. Jerry L. Modisette and David R. Schryer. Mar. 1960. 25p. OTS.

A theoretical analysis of the oxidation rate of a metal forming a volatile oxide indicates diffusion of oxygen to the metal surface to be a rate-controlling factor. The oxidation rate of one such metal, molybdenum, has been measured in the temperature range 1945°R to 2959°R in a flowing gas stream and found to increase with temperature as well as diffusivity and flow velocity. A rate equation correlating these factors for temperatures at which the oxide is gaseous has been derived. The activation energy of the oxidation of molybdenum in the temperature range 2450°R to 2950°R has been determined by use of this equation to be approximately 38.3×10^3 British thermal units per pound-mole of oxygen consumed. (auth)

9739 NDA-15K-3

Nuclear Development Corp. of America, White Plains, N. Y.

AEC SAFETY MONOGRAPH. CHAPTER 11. METAL–WATER REACTIONS. W. L. Brooks and H. Soodak, eds. [1956]. Decl. Dec. 29, 1959. 21p. OTS.

Reactions of reactor materials or coolants with water are considered. Aspects such as the reaction heat quantity, rate of reaction, self-sustaining characteristics of the reaction, and the quantity of hydrogen produced are evaluated. The most dangerous reactions are discussed, and results of in-pile tests of various metals are included. (J.R.D.)

9740 WAPD-BT-16(p.49-72)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

EVALUATION OF THE CORROSIVE EFFECTS OF A CONCENTRATED OXIDIZING DECONTAMINATION SOLUTION ON REACTOR PLANT CONSTRUCTION MATERIALS. W. Resnick and E. Rau. 24p.

An evaluation of the corrosive effects of a concentrated oxidizing decontamination solution, COD (S.4), on Shippingport PWR construction materials has been completed. The test conditions used were: (1) exposure to COD (S.4) at 180 to 200°F under both static and flow conditions with total exposure period equaling the estimated time needed to fill, circulate, and drain the solution from the plant, (2) tests at 275 to 300°F to simulate overheating the solution, and (3) tests at 500°F to simulate heating of retained solutions to operating temperature. The results of these tests indicate that, with the exception of pump materials which will undergo further investigation in the near future, COD (S.4) does not attack PWR construction materials to such an extent as to preclude successful post decontamination plant operation. (auth)

9741 WAPD-BT-16(p.112-33)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

CAUSTIC-INDUCED STRESS CRACKING OF STAINLESS STEEL. F. W. Pement. 22p.

Tests were conducted to determine what combinations of temperature and lithium hydroxide concentration are required to cause cracking of austenitic stainless steel samples containing high residual stresses. The results were rather erratic; however, it was evident that failures were dependent on both temperature and base concentration, with little tendency for cracking at concentrations of 0.1 molar or below and that failures resulted from intergranular attack. Even with the highly susceptible samples studied, these tests show that some process of concentration by a factor of over 1000 would be required before harmful effects are caused by the presence of LiOH in primary coolant at pH 10—a very unlikely possibility for PWR. (auth)

9742 WAPD-BT-16(p.134-46)

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

VAN DE GRAAFF STUDY: FOURTH INTERIM REPORT ON THE DEPOSITION OF CORROSION PRODUCTS UNDER IRRADIATION. G. P. Simon. 13p.

The Van de Graaff studies were initiated to develop the quantitative effects of various conditions of water chemistry on the deposition of corrosion products by ionizing radiation. This article, the fourth of this series, covers results obtained on the effect of high pH and dissolved oxygen on the release and deposition of carbon steel corrosion products. Preliminary results are also reported for the effect of corrosion product availability and added salts. (auth)

9743 YAEC-116

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

DYNAMIC SCREENING CORROSION TESTS OF YANKEE

MATERIALS OF CONSTRUCTION IN HIGH TEMPERATURE BORATED WATER. A. Krieg. Jan. 1959. 61p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

Screening corrosion tests of primary system materials of construction for the Yankee reactor were carried out for one month periods at 600°F, 1800 to 1850 psi, and at a flow velocity of 36 to 40 feet per second in water containing a range of boric acid concentrations without and with lithium hydroxide addition. Lithium hydroxide addition, in trace quantities, was found generally to reduce corrosive attack on the materials tested. No tendency toward stress corrosion cracking of AISI Type 304 stainless steel was observed at stresses up to 75 per cent of the yield point. Certain problems relative to the behavior of the control rod material (silver–indium–cadmium alloy) were noted. (auth)

9744 CEA-tr-R-764

LA CORROSION DES ACIERS INOXIDABLES AU CONTACT AVEC LES MATÉRIAUX NON MÉTALLIQUES. (Corrosion of Stainless Steel in Contact with Non-Metallic Materials). I. B. Ulanovskiĭ (Oulanovsky) and Yu. M. Korovin (Iou. M. Korovine). Translated into French by B. De Trezvinsky from Zhur. Priklad. Khim. 31, 1366-70(1958). 11p.

A study was made of the corrosion of IX-13(GOST 5632-51) steel in contact with Plexiglas and Textolite in Black Sea water at 15 to 16°C. The principle effect was that of inactivation of the metal surface at contact by local lowering of the pH, involving a galvanic couple. A simple, rapid method for determining the tendency of stainless steels to corrode on contact is described. (T.R.H.)

9745

THE BEHAVIOR OF 18-8 STAINLESS STEEL IN 20° Bé HNO_3, CONTAINING CHLORINE. Anna Prati (Istituto Sperimentale dei Metalli leggeri, Novara, Italy). Chim. e ind. (Milan) 42, 145-50(1960) Feb. (In Italian)

Results of some laboratory tests carried out in order to determine the lowest content of chloride, which can be tolerated in regard to the corrosion resistance, effects of the material (stainless steel 18/8) in an HNO_3, absorption vessel where the concentration of the acid was at 20° Be, are described. The minimum chlorine content practically tolerable resulted to be 9.2 g/l. (auth)

9746

RELATIONSHIP OF MICROSTRUCTURE AND STRESS CORROSION CRACKING OF TYPE 410 STAINLESS STEEL. P. S. Trozzo and R. F. McCartney (U. S. Steel Corp., Monroeville, Penna.). Corrosion 16, No. 3, 26-8, 30(1960) Mar.

Three heats of AISI Type 410 stainless steel that exhibited different degrees of susceptibility to stress corrosion fracture in pure-water environments were investigated by electron microscopy and diffraction techniques to correlate microstructure with stress corrosion fracture behavior. In the hardened condition and tempered at 650°F, these steels cracked at stresses as low as 40,000 psi along networks of essentially untempered martensite in the prior austenite grain boundaries. Tempering at a temperature (1175°F) high enough to break up the continuous network in the prior austenite grain boundaries reduced stress corrosion susceptibility, but at the expense of a reduction in tensile properties. (auth)

9747

HIGH TEMPERATURE–HIGH PRESSURE CORROSION OF ZIRCONIUM IN HYDROCHLORIC ACID. W. E. Kuhn (Carborundum Co., Niagara Falls, N. Y.). Corrosion 16, 136t-44t(1960) Mar.

The corrosion of zirconium in HCl was studied at 150 to 250°C in aqueous solutions containing 5 to 37 percent by weight of HCl. Studies of the dependence of the corrosion rate on temperature and time were conducted, and the experimental data correlated with studies of the corrosion products, surface films, and the metallurgical structure and chemical composition of the substrate. The kinetics are also given. Hydrogen was found to play an important role in the corrosion mechanism as a surface coating of zirconium monohydride and dissolved in the zirconium lattice. Initially, an accelerating corrosion rate was found with time, followed by a transition to a decreasing corrosion rate. It was concluded that the corrosion mechanism was controlled by the initial reaction up to the transition point, beyond which it is suggested that the reaction is either diffusion controlled and/or influenced by hydrogen adsorbed at the surface. Intergranular corrosion of alpha-annealed zirconium and attack at both the grain boundaries and between the alpha needles of beta-treated furnace cooled zirconium were observed at the higher temperatures. The beta-treated furnace cooled zirconium was more resistant to attack by HCl than the alpha-annealed zirconium. Much improved corrosion resistance to HCl may be expected with higher purity metal. In this respect the zirconium used in this study does not represent the higher quality metal being produced today by advanced processing, melting, and fabrication techniques. (auth)

Fabrication

9748 58-RL-2058

General Electric Co. Research Lab., Schenectady, N. Y.
SLIP CASTING METAL POWDERS: MOLYBDENUM.
P. D. S. St. Pierre. July 17, 1958. 15p.

The concepts involved in slip casting metal powders are discussed with special reference to molybdenum. It is recommended that molybdenum powder be milled to 50% less than 5 microns in an oxygen-free atmosphere. A slip may then be made up in polyvinyl alcohol solution, and after acidity adjustment to pH 6 to 7, it may be cast into ordinary ceramic grade plaster molds. A liquid to solid volume ratio of 1:1.25 is suitable for many purposes. The effects of chemistry and vehicle dilution on the rheology of the slip are discussed. The need for balancing the advantages of small particle size powder against the reactivity of the large surface involved is stressed. It is shown that casting into sand molds is possible and has many desirable features. It is concluded that molybdenum can be slip cast in the same fashion as ceramics and that the slip behaves in the same way. Because of the greater reactivity of the metal powder, however, changes in the slip occur more quickly than in ceramic suspensions. An understanding of the principles connected with slip casting molybdenum leads to an appreciation of the factors likely to be involved in casting other metals. (auth)

9749 ANL-5950

Argonne National Lab., Lemont, Ill.
CASTING AND FABRICATION OF CORE MATERIAL FOR ARGONNE LOW POWER REACTOR FUEL ELEMENTS.
R. L. Salley and W. R. Burt, Jr. Dec. 1959. 66p. Contract W-31-109-eng-38. OTS.

The manufacture of fuel blanks used in the fabrication of fuel elements for the Argonne Low Power Reactor is described. The thin, plate-type elements contain a wrought aluminum-base core alloy with a nominal composition of 17.5 wt.% enriched uranium, 2.0 wt.% nickel, and 0.5 wt.% iron, clad with an aluminum–nickel alloy. The fuel ele-

ments were fabricated by a picture-frame technique, employing elemental silicon bonding and followed by hot and cold rolling to size. Development, casting, hot and cold rolling, cleaning, and punching of core blanks are discussed. A description of the nondestructive testing method and an evaluation of the manufacturing processes are given. (auth)

9750 BRB-38
Bridgeport Brass Co., Conn.
PROCESS DEVELOPMENT QUARTERLY REPORT [FOR] JANUARY–MARCH 1957. June 30, 1957. Decl. Feb. 4, 1960. 80p. Contract AT(30-1)-1405. OTS.

Experiments with extrusion and drawing of U are described. Efforts in experimental hollow extrusions have concentrated on developing longer mandrel lives. Extrusion of Hanford solid slugs, Hanford I and E type II-B slugs, and SRP hollow slugs is also described. (T.R.H.)

9751 BRB-39
Bridgeport Brass Co., Conn.
PROCESS DEVELOPMENT QUARTERLY REPORT [FOR] APRIL–JUNE 1957. Nov. 15, 1957. Decl. Feb. 4, 1960. 80p. Contract AT(30-1)-1405. OTS.

In additional U rod drawing investigations, it was found that drawing can effectively reduce the depth of surface defects. Water glass shows promise in initial tests as an improved carrier base for the drawing lubricant. By using billet temperatures of 1800 or 1900°F, the first essentially complete gamma-phase extrusions were made. Completed results are presented of an extensive fundamental investigation of mandrel design variables for the production of small I. D. heavy-wall SRO-type tube using Al metal. Results of Hanford and Savannah solid and hollow slug extrusions are given. (W.L.H.)

9752 BRB-47
Bridgeport Brass Co., Conn.
PROCESS DEVELOPMENT QUARTERLY REPORT [FOR] APRIL–JUNE 1958. Feb. 15, 1959. Decl. Feb. 4, 1960. 74p. Contract AT(30-1)-1405. OTS.

The economics for the I and E process involving a tipped mandrel are economically borderline. Further investigations will be conducted with a projectile-type mandrel in place of the straight tip. A corrosion study substantiated a need for cleaning extrusions immediately after extrusion and preventing moisture pickup before machining. The final extrusion in the project to establish a manufacturing process for the solid slug was completed. Attempts were made to extrude I and E type tubing by means of a porthole die and a co-extrusion. A basic study into the effect of billet material and extrusion ram speed was completed on solid rod. (W.L.H.)

9753 DP-16
Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., [Wilmington, Del.].
SIGMA PLUG WELDING OF SPUN-OVER FUEL CANS. F. J. Winsor. Dec. 1952. Decl. Jan. 28, 1960. 26p. Contract AT(07-2)-1. OTS.

Efforts made to employ the sigma welding process for plug welding closures in spun-over fuel cans were unsuccessful. No combination of welding conditions was found which would produce satisfactory, leak-tight, plug welds in aluminum. (auth)

9754 N-1322F
National Research Corp., Cambridge, Mass.
SUMMARY "A" REPORT [ON] METALS RESEARCH PROJECT. Robert A. Stauffer. Oct. 10, 1944. Decl. Feb. 4, 1960. 61p. Contract W-7405-eng-293. OTS.

Research was undertaken to find a means of making precision castings of U by the use of the Austenal technique for making molds coupled with vacuum centrifugal casting. The requirements in this operation were to be a pressure of better than one micron of mercury absolute to be maintained during casting and as rapid a method of melting and handling of the metals as could be obtained. The latter requirement, it was believed, could best be met by the use of induction heating in vacuum. (auth)

9755 NAA-SR-Memo-4378
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRODUCTION AND FABRICATION OF UC BY ARC MELTING. D. H. Turner. Sept. 15, 1959. 14p. OTS.

A non-consumable electrode skull casting method was used for the fabrication of dense, high-purity UC fuel slugs. (W.L.H.)

9756 NASA-TN-D-263
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
EFFECTS OF MELTING PRACTICE AND ALUMINUM COATING ON THE LIFE OF GMR 235 BUCKETS OPERATED AT 1650°F IN A TURBOJET ENGINE. C. A. Gyorgak, J. R. Johnston, and J. W. Weeton. Mar. 1960. 44p. OTS.

Eight groups of GMR 235 buckets, four from vacuum-melted and four from air-melted master heats, were evaluated in a J33-9 engine. Some buckets from both heats were aluminized. The engine test, operated under cyclic conditions, was terminated after 269 hours of accumulated rated-speed operating time. Buckets were subjected before and after each test to macrographic inspection, metallographic studies, and hardness determinations. Results showed that vacuum melting increased bucket life from 10 to more than 250 hours when performance was based on time to fracture. (auth)

9757 ORO-254
Carborundum Co., Niagara Falls, N. Y.
SYNTHESIS AND FABRICATION OF REFRACTORY URANIUM COMPOUNDS. Monthly Progress Report No. 5 [for] December 1 to December 31, 1959. K. M. Taylor, C. A. Lenie, P. E. Doherty, L. N. Hailey, and T. J. Keaty. Jan. 8, 1960. 6p. Contract AT(40-1)-2558. OTS.

The following two methods were used to prepare a total of about 1500 grams of UN: nitriding the metal powder and nitriding a mixture of UO_2 and C. Pellets having an average of about 94% of theoretical were obtained by sintering finely milled UN powder at 1750°C. Based on x-ray analysis only, good quality U_3Si_2 was prepared by reacting the elements at 1550°C. Pellets of U_3Si_2 having a density of about 93% of theoretical were obtained by sintering the finely milled U_3Si_2 powder at 1300°C. (W.L.H.)

9758 ORO-256
Union Carbide Metals Co., Niagara Falls, N. Y.
COLUMBIUM CLAD URANIUM CARBIDE FUEL ELEMENT CONTRACT. Monthly Letter Report [for] December 1 through December 31, 1959. J. J. Finley, M. Korchynsky, and S. Sarian. 3p. Contract AT(40-1)-2559. OTS.

The production of UC, hot pressing, induction melting, cold pressing, and sintering are reported. The interaction between UC and Nb-base alloys is being investigated. (W.L.H.)

9759
AGGREGATES AND AGGRAVATIONS OF HEAVY-WEIGHT CONCRETE. L. D. Long and J. R. Clements (The Gulick-Henderson Labs., Inc., Flushing, N. Y.). Civil Eng. 29, 62-4(1959) Dec.

The physical properties of limonite, barite, magnetite,

ilmenite, steel punching, steel sand, ferrophosphorus, and boron aggregates are given. Problems in proper mixing and fabrication are discussed. (C.J.G.)

9760
ON THE DIFFUSION WELDING OF URANIUM AND ZIRCALOY-2. G. Perona, C. Corsetti, E. Brutto, and A. Bassi (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 7, 111-20(1960) Feb. (In Italian)

The results obtained and the experimental method used to find more suitable conditions for a good diffusional bonding of uranium and Zircaloy-2 are described. An interpretation of the observed phenomena is also proposed. (auth)

9761
POSSIBILITY OF OBTAINING A METALLURGICAL SOLDERING OF STAINLESS STEEL TO ZIRCALOY-2. A. Bassi, E. Brutto, C. Corsetti, and G. Perona (Centro Informazioni Studi Esperienze, Milan). Met. ital. 51, 509-14(1959). (In Italian)

The difficulty of joining stainless steel tubes to Zircaloy-2 is discussed, and preliminary experiments with various techniques for accomplishing this are reported. In the search for a metal to put between the two which has the proper diffusion, nuclear, and corrosion characteristics, joints between stainless steel and Ni, Cu and Ni, Ag and Zircaloy, and Cu and Zircaloy were prepared and tested. It was concluded that at the present stage of the study the best results were obtained by a solid state diffusion directly between stainless steel and Zircaloy at temperatures below 1050°C. (T.R.H.)

9762
METALLOGRAPHIC TECHNIQUES FOR AGE HARDENING HIGH-TEMPERATURE ALLOYS. R. P. Morenski and N. S. Pitea (International Nickel Co., Bayonne, N. J.). Metal Progr. 77, 99-100(1960) Mar.

Many superalloys designed for high-temperature applications are hardened by titanium. Nickel-base superalloys are age hardened by precipitating Ni_3Ti, an intermetallic compound. The metallographic technique needed to reveal the changes in microstructure which occurs in this alloy is described. The transformation of Ni_3Ti, the age hardening constituent, from the face-centered cubic form to the hexagonal close-packed form occurs inside the grains and at the boundaries. Included are the resultant hardness values for the aging temperatures of the specimens. (B.O.G.)

9763
SPOT WELDING OF CARBON STEEL. I. W. Johnson (General Electric Co., Schenectady, N. Y.). Welding J. (N. Y.) 39, 89-96-s(1960) Mar.

Metallurgically, spot welding differs from other welding processes primarily because of the greater speed in reaching welding temperature and the very rapid cooling of the weld and adjacent heat-affected zone. Low-carbon steel presents no difficult metallurgical problems. However, an increase of carbon content into the medium-carbon range necessitates postheat treatment. Electronic controls are available that permit a postheat treatment in the spot-welding machine. Tensile-shear strength varies directly with the diameter of the spot weld at the interface. It can be calculated roughly, based on the area at the interface and the strength of the material in the annealed state. Fatigue strength of spot welds is inherently low. This is a mechanical phenomenon and not a metallurgical change due to the welding heat. Fatigue failures initiate at the interface and are not visible on an assembly until complete failure is about to occur. The important design factors are: overlap, spot spacing, spot strength, and accessibility. Rules of thumb may be used for approximations. Cleaning prior to welding insures uniform surface conditions and improves consistency of welds. Optimum welding procedures are necessary for highest quality welds. Deviations from the optimum will result in decreased strength, more inconsistencies, and increased internal defects. It is more economical to make the highest quality weld than one of poor quality. There are no known nondestructive tests for spot welds that are totally reliable. Of the several destructive tests, the peel test offers the simplest, easiest to execute, and most effective single test. Coated steels such as galvanized, cadmium and tin plate, aluminized steel may be spot welded with varying degrees of difficulty. (auth)

9764
SPOT AND SEAM WELDING OF ZIRCALOY 3. E. F. Nippes, W. F. Savage, and K. C. Wu (Rensselaer Polytechnic Inst., Troy, N. Y.). Welding J. (N.Y.) 39, 97-104-s(1960) Mar.

Zircaloy 3, an alloy of zirconium with nominal composition of 0.25% tin and 0.25% iron, is an ideal structural material for nuclear reactors. It combines reasonably high mechanical strength with a low-capture cross section for thermal neutrons. The optimum spot-welding conditions for 0.062- and 0.110-in. Zircaloy 3 sheet were determined. The optimum conditions for seam welding were determined only for the 0.062-in. sheet. To obtain a consistent weld strength, the tenacious, low-conductivity surface film must be removed from the surface of Zircaloy 3 sheet. A pickling solution consisting of 100 parts concentrated HCl (assay 37%) with 1 part 48% HF was found to be satisfactory for removing the surface film. After one minute in this solution, a consistent surface-contact resistance of the order of 40 microhms was obtained. To simulate actual practice, the effect of storage environment after pickling was studied. The tensile-shear strength of spot-welded Zircaloy 3 was high; its normal-tension strength was comparatively low. Welding under an argon atmosphere improved both the tensile-shear and normal-tension strength, but did not materially change the ductility ratio. Tests performed at 500°F showed a decrease in the tensile-shear strength and an increase in the normal-tension strength and the ductility ratio. (auth)

9765
IMPROVEMENTS IN OR RELATING TO COATING OF URANIUM METAL AND URANIUM-BASE ALLOY. Roy Alfred Ulfkettle Huddle and Allan Robert Gibson (to United Kingdom Atomic Energy Authority). British Patent 829,089. Feb. 24, 1960.

A method is given for coating U and U alloys with a base for electrodeposited coatings. The U or U alloy is heated with a metal or oxide powder mixed with halide or oxyhalide. In an example U was cleaned and dried and immersed in a powdered mixture of Be and 25 wt.% $BeCl_2$ and heated to 500°C for 4 hr. Alternatively $AlCl_3$ may be substituted for the $BeCl_3$ and a shorter time at 420 to 450° is possible. (T.R.H.)

Properties and Structure

9766 BMI-862
Battelle Memorial Inst., Columbus, Ohio.
URANIUM MIGRATION IN UO_2-BEARING CERAMICS. J. F. Quirk, E. F. Ferrell, A. K. Smalley, and W. H. Duckworth. Sept. 4, 1953. Decl. Feb. 16, 1960. 30p. Contract W-7405-Eng-92. OTS.

A preliminary study was made of U migration in pressed and sintered UO_2-bearing bodies based on $MoSi_2$ or Al_2O_3. For $MoSi_2$-core bodies containing 23 wt.% of UO_2 clad with UO_2-free $MoSi_2$, migration of U was limited to less than 0.002 in. during sintering at 2700°F and subsequent exposure in air at 2500°F for 140 hr. The sintered $MoSi_2$-base elements were strong, dense, impervious, and resistant to oxidation in air at 2500°F. Attempts to fabricate impervious Al_2O_3-base core bodies containing up to 46.2 wt.% of UO_2 were not successful using powder compacts and sintering in the purified atmospheres required to maintain U placement. (auth)

9767 BMI-1420

Battelle Memorial Inst., Columbus, Ohio.

EFFECTS OF YTTRIUM ON THE FABRICATION AND TENSILE PROPERTIES OF TWO MODIFIED STAINLESS ALLOYS. John A. DeMastry, Frederic R. Shober, and Ronald F. Dickerson. Feb. 24, 1960. 17p. Contract W-7405-eng-92. OTS.

Alloys containing 55 wt.% iron–22 wt.% nickel–17 wt.% chromium–2.5 wt.% molybdenum–1.0 wt.% niobium–0.03 wt.% carbon–0.5 wt.% manganese–0.5 wt.% silicon with nominal additions of from 0 to 1.5 wt.% yttrium, and 36 wt.% iron–37 wt.% nickel–18 wt.% chromium–2.5 wt.% molybdenum–1.5 wt.% niobium–1.0 wt.% aluminum–0.05 wt.% carbon–0.5 wt.% manganese–0.5 wt.% silicon with nominal additions of from 0 to 2.0 wt.% yttrium, were prepared by vacuum-induction melting. Alloys containing 55 wt.% iron were successfully forged in air at 1900°F, rolled at 1850°F to 0.060-in. sheet and cold rolled to 0.015-in. sheet. Fabrication of alloys containing 36 wt.% iron with more than 0.5 wt.% yttrium was unsuccessful. Addition of yttrium had relatively no effect on the yield and ultimate strength from room temperature to 1850°F. The ductility of fabricable alloys studied was increased at elevated temperatures by increasing yttrium contents. The greatest increase in ductility occurred at 1.5 wt.% yttrium. (auth)

9768 CEA-1107

France. Commissariat à l'Énergie Atomique, Paris.

CONTRIBUTION A L'ETUDE STRUCTURALE ET CINÉTIQUE DE LA TRANSFORMATION LENTE D'UN CRISTAL DE FER ALPHA OU D'URANIUM ALPHA. (A Contribution to the Structural and Kinetic Study of the Slow Transformation of an Iron or Uranium Alpha Crystal). Gérard Donze. Dec. 17, 1958. 35p.

Thesis submitted to Univ. of Nancy.

A curious phenomenon of regeneration of an iron or uranium α crystal in the double transformation of iron or uranium $\alpha \rightarrow \gamma \rightarrow \alpha$ and $\alpha \rightarrow \beta \rightarrow \alpha$, respectively, was studied. This phenomenon does not occur with very pure metals, but only in the case of metals containing impurities, and more particularly, containing carbon. The monocrystal is not regenerated unless care is taken not to exceed final transformation temperatures by more than a few degrees. The same phenomenon is encountered in polycrystalline compounds: the orientation of the crystals is maintained, though the respective grain positions ("joints") are considerably displaced. Kinetic study of the transformation at cooling, on the one hand, and the analysis of the texture at the γ phase (iron) on the other, show that regeneration results from the conservation of the phase α germs at the high temperature phase. They appear to be relatively stable, for at the end of 24 hours at the experiment temperature, they had retained their properties. Study of the twin crystals of γ iron engendered by the transformation $\alpha \rightarrow \gamma$ demonstrated that there is no orientation relationship in the transformation: $\alpha \rightarrow \gamma$ of pure iron. Thanks to the production of an epitaxic oxyde film on the surface of γ iron, we were able to evidence a new type of iron transformation twinned crystal which grows in one direction (110) and is in contact also at 110. Formed of very thin lamina, these crystals are very instable and become penetrants, each element, much larger, consisting of the increased thickness of a certain number of lamina. (auth)

9769 CEA-1189

France. Commissariat à l'Énergie Atomique, Paris.

ÉTUDE DES FLUCTUATIONS D'AIMANTATION DANS LE FER AU VOISINAGE DE LA TEMPÉRATURE DE CURIE PAR DIFFUSION DES NEUTRONS. (Study by Neutron Diffusion of Magnetic Fluctuations in Iron in the Curie Temperature Region). Magda Ericson-Galula. Dec. 1958. 44p.

Thesis submitted to the Univ. of Paris.

The critical diffusion of neutrons in iron is due to the magnetization fluctuations which occur in ferromagnetic substances in the neighborhood of the Curie temperature. The fluctuations can be described in correlation terms; a correlation function $\gamma_{\vec{R}}(t)$ is defined, $\gamma_{\vec{R}}(t) = \langle \vec{S}_0(0)\vec{S}_1(t) \rangle$ mean value of the scalar product of a reference spin and a spin situated at a distance (R) from the first and considered at the instant t. The generalities on neutron diffusion cross sections are recalled and a brief summary is given of the theory of Van Hove, who has shown that the magnetic diffusion cross section of neutrons is the Fourier transformation of the correlation function. The spatial dependence of the correlation function, assumed to be independent of time is studied. It can then be characterized by two parameters K_1 and r_1, by means of which the range and intensity of the correlations can be calculated, respectively. After setting out the principle of the measurement of these parameters, the experimental apparatus is described. The experimental values obtained are in good agreement with the calculations, and the agreement is better if it is supposed that the second and not the first neighbors of an iron atom are magnetically active, as proposed by Neel. The evolution with time of the correlation function was studied. This evolution is characterized by a parameter A depending on the temperature, which occurs in the diffusion equation obeyed by the magnetization fluctuations. $\partial\vec{M}/\partial t = A \nabla^2 \vec{M}$. The principle of the measurement of A is given, after which the modifications carried out on the experimental apparatus mentioned are described. The results obtained are then discussed and compared with the theoretical forecasts of De Gennes, made by using the Heisenberg model and a simple band model; our values are in good agreement with those calculated in the Heisenberg model and exclude the band model used. (auth)

9770 DMIC-Memo-43

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

NOTES ON MECHANICAL TESTING TECHNIQUES AT VERY LOW TEMPERATURES. James E. Campbell. Feb. 19, 1960. 8p. (PB-161193).

Several techniques were developed for evaluating the mechanical properties of materials at temperatures in the range between –423 and –452°F, the boiling points of liquid hydrogen and liquid helium. (W.L.H.)

9771 GA-782

General Atomic Div., General Dynamics Corp., San Diego, Calif.

GRAPHITE–METAL COMPATIBILITY AT HIGH TEMPERATURES. J. C. Bokros. June 1959. 73p. Contract AT(04-3)-187. OTS.

The reaction of numerous metals and alloys to graphite

at 1500°F was studied. It was found that the heat-resistant nickel-base alloys, the stainless steels, and molybdenum all carburize rapidly above 1500°F. Niobium absorbs and becomes embrittled by impurity gases in helium. The alloys containing aluminum and the nickel-base alloys containing chromium were internally oxidized by an impurity in the helium. Of the alloys tested, only nickel and nickel-copper alloys appeared promising for a cladding. Preliminary data indicate that carburization of nickel and Monel at 1700°F did not decrease their room-temperature ductility. (auth)

9772 GA-849

General Atomic Div., General Dynamics Corp., San Diego, Calif.

COMPATIBILITY OF ZIRCONIUM HYDRIDE AND CARBON DIOXIDE. H. E. Shoemaker. July 1959. 19p. Contract AT(04-3)-187. OTS.

The stability of unclad zirconium hydride was investigated as a reactor moderator in carbon dioxide coolant. Two ranges of hydride were tested, an alpha- plus delta-phase hydride ($ZrH_{0.9\pm0.2}$) and a delta-phase hydride ($ZrH_{1.5}$). The delta-phase hydride exhibited excellent dimensional stability, but suffered as great as 20% hydrogen loss at 1200°F, together with severe corrosion. The alpha-plus delta-phase hydride swelled and warped in a temperature gradient but did not lose much hydrogen and did not corrode severely even at 1200°F. The results indicate that zirconium hydride could not be used as unclad moderator in a carbon dioxide atmosphere in the temperature range desired for the Maritime Gas Cooled Reactor. (auth)

9773 NASA-TN-D-272

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

THERMAL-STRESS FATIGUE CRACKING OF TURBINE BUCKETS OPERATED AT 1700°F IN A TURBOJET ENGINE WITH LONG PERIODS OF OPERATION BETWEEN STARTS. Robert A. Signorelli, James R. Johnston, and William J. Waters. Feb. 1960. 22p. OTS.

Thermal-stress fatigue resistance of alloys Sel-1, B & B, forged Udimet 500, and Inconel 713 was studied at 1700°F in a J47 engine with an average of 11 hours at rated speed between starts. These data were compared with those of a previous investigation with an average of 1.4 hours of rated-speed operation between starts. The data include the number of starts to cause bucket cracking, the number of starts to crack 50 per cent of the buckets of each alloy group, and the mode and rate of crack progression to cause fracture of buckets. (auth)

9774 NP-8392

Westinghouse Electric Corp. Research Labs., Pittsburgh.

DEVELOPMENT OF NIOBIUM BASE ALLOYS. Quarterly Progress Report No. 1 [covering Period] May 1, 1959 to August 1, 1959. R. T. Begley and A. I. Lewis. Dec. 15, 1959. 36p. Contract AF33(616)-6258.

Studies of the effects of oxygen, nitrogen, and carbon on the properties of niobium were carried out. Niobium–oxygen and niobium–nitrogen alloys, prepared by levitation melting, were evaluated on the basis of as-cast hardness, cold workability, strain-hardening, and recrystallization behavior. Hardness and workability data on arc melted niobium–carbon alloys were also obtained. Of the interstitial elements studied, nitrogen was the most effective hardener at low concentrations. On a weight per cent basis, nitrogen and carbon additions appear to be more detrimental to the cold workability of niobium than oxygen. Studies of niobium base alloys currently in progress are briefly outlined. (auth)

9775 ORNL-2407

Oak Ridge National Lab., Tenn.

RELAXATION CHARACTERISTICS OF INCONEL AT ELEVATED TEMPERATURES. C. R. Kennedy and D. A. Douglas. Feb. 12, 1960. 28p. Contract W-7405-eng-26. OTS.

A stress-relaxation machine has been developed capable of providing very precise results throughout the useful temperature range of common structural metals. Among the advantages claimed for this machine are: dynamic response, sensitive control, and low cost. It is demonstrated that with the use of a single specimen and relatively short testing times, a complete set of stress-strain rate values can be obtained at any desired temperature. The reliability of the testing device and the analytical model is shown in the comparison of values predicted from relaxation tests with those obtained in constant-stress creep tests. It should be emphasized that the relaxation test is not a substitute for the creep test. However, it does provide a check on the accuracy of the law assumed for the constant-stress creep data and provides additional information which assists the metallurgists in establishing more exact analytical models to describe the deformation process. (auth)

9776 WADC-TR-59-416(Pt. I)

New York Univ., New York.

INVESTIGATION OF CREEP BUCKLING OF COLUMNS AND PLATES. I. ELEVATED TEMPERATURE PROPERTIES OF THE TEST MATERIAL Ti–7Al–4Mo TITANIUM ALLOY. Ralph Papirno and George Gerard. June 26, 1959. 33p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE AND CREEP OF MATERIALS. Contract AF33(616)-5807. OTS.

As a first phase of an investigation of the creep buckling of columns and plates, materials properties tests were conducted on Ti–7Al–4Mo Titanium Alloy in both the annealed and heat treated conditions. Heat treatment to obtain optimum creep performance was 1450°F-1 hr, FC to 1050°F, AC; 1050°F-24 hr, AC. A new technique for the collection of compression creep data from sheet specimens was developed in which both the short time stress-strain properties prior to creep and the creep data itself are autographically recorded. Short time tests were conducted at room temperature, 750, 850, and 950°F. Compressive creep data were collected at 850 and 950°F. (auth)

9777 WADC-TR-59-441(Pt. I)

Materials Research Corp., Yonkers, N. Y.

THE INVESTIGATION OF THE MECHANISM OF SUBSTRUCTURAL FORMATION IN REFRACTORY METALS AND THE RELATION TO THE OBSERVED MECHANICAL PROPERTIES. [Period covered] June 15, 1958 to June 15, 1959. A. Iannucci, J. Intrater, G. Murray, and S. Weinig. July 1959. 31p. Project title: METALLIC MATERIALS. Task title: REFRACTORY METALS. Contract AF33(616)-5908. OTS.

The formation of substructure in molybdenum as a function of prestrain and polygonization anneal temperature has been demonstrated by metallographic and x-ray techniques. The x-ray-diffraction line width is markedly increased by the presence of substructure. In both polycrystalline and single crystal creep tests the creep resistance increased as a function of prestrain. In single crystal tests the creep resistance decreased with increased polygonization anneal time. (auth)

9778 WADC-TR-59-454

Michigan. Univ., Ann Arbor. Research Inst.

EFFECT OF PRIOR CREEP ON THE MECHANICAL PROPERTIES OF A HIGH-STRENGTH HEAT-TREATABLE

TITANIUM ALLOY, Ti-16V-2.5Al. [Period covered]: July 8, 1958 to March 31, 1959. Jeremy V. Gluck and James W. Freeman. June 19, 1959. 75p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE AND CREEP OF MATERIALS. Contract AF33(616)-3368. OTS.

The effect of creep to 2% in 10 or 100 hours at temperatures from 600 to 900°F was determined on the tension, compression, and tension-impact properties of Ti–16V–2.5Al at room temperature or the exposure temperature. Prior creep at 600°F raised ultimate tensile and yield strength. Lesser changes were found at higher temperatures. Changes in properties are attributed to a combination of stress-accelerated age-strengthening and a Bauschinger effect. (auth)

9779 AEC-tr-3988

SHEATHS FOR IMMERSION THERMOCOUPLES. O. M. Margulis, L. G. Romanchenko, and L. V. Vinogradova. Translated from Ogneupory 24, 157-61(1959). 12p. JCL or LC.

A study was made of immersion thermocouple sheaths prepared from technical-grade alumina. A flow sheet is contained for casting and coating processes. The methods of preparation and production of fine powders, sheath preparation, effects of firing conditions, and effects of 1% TiO_2 addition are discussed. (C.J.G.)

9780 AEC-tr-3992

BERYLLIUM FLUORIDE AND FLUOROBERYLLATES. A. V. Novoselova. Translated by C. B. Finch (Oak Ridge National Lab.) from Uspekhi Khim. 27, 33-43(1959). 21p. (Includes 5p. of original). JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 10102.

9781 CEA-tr-R-781

DIAGRAMME D'ÉTAT DU SYSTEME NIOBIUM–TUNGSTENE. (Phase Diagram of the System Niobium–Tungsten). V. (W.) S. Mikheev and D. M. Pevtsov. Translated into French from Zhur. Neorg. Khim. 3, 861-6(1958). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15575.

9782 NP-tr-360

INCREASING THE ELECTRIC RESISTANCE OF FILAMENTARY CATHODES MADE OF BORIDES OF RARE-EARTH METALS. (Povysheniye Elektrosoprotivleniya Pryamonakal'nykh Katodov iz Boridov Redkozemel'nykh Metallov). G. V. Samsonov, V. S. Neshpor, and T. I. Serebryakova. Translated from Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. No. 2, 118-20(1959). 7p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20926.

9783 UCID-926

MEASUREMENTS OF THE ELECTRICAL CONDUCTIVITY OF HIGH PURITY ALUMINUM AT LOW TEMPERATURES. INTERNATIONAL INSTITUTE OF REFRIGERATION, 1956. M. Caron. Translated by C. Depew (Univ. of Calif. Radiation Lab.) from Bull. inst. intern. froid annexe 1956-2, 51-62. 11p. OTS.

A relationship was established for high-purity aluminum between the classifications obtained by physical and chemical methods and the classification by measurement of the conductivity at low temperatures. For the relationship to be valid, the conductivity measurement should be performed on appropriately annealed metals. It is shown that by determining the residual resistance of a sample, the composition of aluminum of unknown purity can be determined. (C.J.G.)

9784

IMPROVED NBS ABRASIVE JET METHOD FOR MEASURING ABRASION RESISTANCE OF COATINGS. Aaron G. Roberts (National Bureau of Standards, [Washington, D. C.]). ASTM Bull. No. 244, 48-51(1960) Feb.

A description is given of the many improvements made in the NBS Abrasive Jet Method since publication of the original article describing this rapid, reproducible, and versatile means for measuring the abrasion resistance of organic and other coatings. (auth)

9785

ALUMINUM IN REACTOR CONSTRUCTION. W. Meyer-Jungnick and F. J. Schmidt. Atomkernenergie 5, 58-66 (1960) Feb. (In German)

As an introduction the factors are discussed in general which are of consequence for the choice of materials—especially aluminum—in reactor construction. Among these factors are neutron-physical properties and variations caused by radiation. The physical and mechanical properties of aluminum, production and fabrication, the chemical properties, and particularly corrosion properties in different media, are considered in detail. In the last part a survey is given of the variation of aluminum properties by radiation and of different possibilities of application of aluminum and its alloys, as for example as sheathing material for fuel elements, as alloy element of uranium for fuel elements of the MTR type, as construction material for light and heavy water tanks, and as an essential part of the shielding materials boral and boraal. (auth)

9786

CERAMICS AND CERMETS FOR NUCLEAR FUELS. F. R. Paulsen. Chem. & Process Eng. 41, 49-52(1960) Feb.

The physical properties of various ceramic and cermet materials are compared for use as nuclear fuels. The bonding processes used in cermet fabrication are discussed. (C.J.G.)

9787

THE TELLURIDES OF CERIUM $CeTe_2$ AND Ce_3Te_4. Louis Domange, Jean Flahaut, Marie Paule Pardo, Abbas Naderi Chirazi, and Micheline Guittard. Compt. rend. 250, 857-8(1960) Feb. 1. (In French)

A study was made of the formation and properties of cerium tellurides. $CeTe_2$ was prepared by the direct reaction of exactly calculated quantities of cerium and tellurium at 600°C in a sealed pyrex tube in vacuum. It is quadratic of the Fe_2As type for which the atomic coördinates were determined to be $a = 4.51 \pm 0.01$ kX, $c = 9.10 \pm 0.01$ kX, and $c/a = 2.018 \pm 0.003$. It has two molecules $CeTe_2$ per elementary cell and a density of 7.06 g/ml. There is a region of homogeneity up to the composition $CeTe_{1.83}$. Ce_3Te_4, produced by a rigorous dissociation of $CeTe_2$ in a vacuum at 950 to 1100°C, has a cubic structure of the Th_3P_4 type with $a = 9.547 \pm 0.006$ kX. (J.S.R.)

9788

CORROSION AND WELDABILITY STUDIES ON CHROMIUM–MANGANESE AUSTENITIC STAINLESS STEELS. Donald Warren (E. I. Du Pont de Nemours & Co., Wilmington, Del.). Corrosion 16, 119t-30t(1960) Mar.

Corrosion and weldability studies were made on Cr-Mn-Ni and Cr-Mn-N grades of austenitic stainless steel to determine their usefulness for chemical plant applications. These studies show that the corrosion resistance of Type

202 (18% Cr-5% Ni-8% Mn-0.10% max. C) stainless steel is comparable to that of Type 304 stainless steel in all but the most strongly oxidizing chemical environments. The weldability of the Cr-Mn-Ni and Cr-Mn-N steels is good and equivalent to that of Type 304 stainless steel. Includes history of chromium-manganese stainless steels. Tabular data are included on tests conducted. (auth)

9789

THE WORLD'S HOTTEST ALLOYS. PARTS I AND II. Harry B. Goodwin (Battelle Memorial Inst., Columbus, Ohio). Ind. Research Mag. 1, Nos. 3 and 4. 11p. (1959).

Some properties of the stable elements which have melting points above 3000°F are presented. These include molybdenum, tantalum, niobium, rhenium, chromium, the platinum group, chromium, and metal–ceramic composites. These "scarce" metals are found to exist in the earth's crust sometimes more than the more "common" metals, such as copper, lead, etc. Where copper and lead are found to exist in deposits, the "scarce" metals are found to exist as complexes and are scattered throughout the earth's crust. The most promising of these are niobium, molybdenum, tantalum, and tungsten. A molybdenum wire when heated above 2000°F will oxidize visually, but when it is coated with its disilicide it does not oxidize appreciably. A niobium–45% zirconium–5% titanium alloy was recently developed which is stated to be both oxidation resistant and fabricable. A combination of alloying and coating may be the best solution to the oxidation problem, with alloying serving to prevent coating defects from becoming catastrophic failures. Rhenium may find use in rhenium–molybdenum and tungsten–rhenium/tungsten alloy thermocouples, which are said to be good to 3200 and 4000°F, respectively. Chromium-base alloys almost certainly will be oxidation resistant, and no protective coatings will be required. It is expected that their practical temperature limit will be far below the limits for the other metals discussed. Of the platinum group metals, rhodium appears to be the most oxidation resistant and also has excellent high-temperature strength. The chrome–alumina and nickel or cobalt-bonded titanium carbide type of cermets seems best because of the excellent bond developed between the metal and ceramic in these systems. Such a bond appears essential for a good cermet. Their fracture strengths are of the same order as those of the better all-ceramic materials. In a composite structure, the ductile component is placed where ductility is required and the brittle component where it is not required. Metal is placed in areas subjected to tension and ceramics in those parts which are lightly stressed or subjected to compressive stresses. There is considerable optimism that true ceramics with greatly improved toughness and perhaps even a little ductility can be developed eventually. (B.O.G.)

9790

PREPARATION OF TETRABORON SILICIDE, B_4Si. Ervin Colton (Allis-Chalmers Mfg. Co., Milwaukee). J. Am. Chem. Soc. 82, 1002(1960) Feb. 20.

From a search for high-temperature oxidation-resistant materials, the development of tetraboron silicide, B_4Si, is reported. This silicide of boron can be prepared in large quantities. Shapes fabricated from B_4Si by powder metallurgical techniques have withstood oxidation in air for over 100 hours at 1370°C. Thermal shock resistance was displayed when no cracks were observed upon removal from 1370°C to room temperatures on numerous occasions. The ceramic properties of B_4Si are being investigated. (B.O.G.)

9791

NEUTRON DIFFRACTION STUDY ON SODIUM TUNGSTEN BRONZES Na_xWO_3($x = 0.9 \sim 0.6$). Masao Atoji and R. E. Rundle (Iowa State Univ., Ames). J. Chem. Phys. 32, 627-30(1960) Feb.

A neutron diffraction study of Na_xWO_3 (sodium tungsten bronze) with $0.86 > X > 0.56$ was performed. The crystals were prepared by the electrolytic reduction of a Na_2WO_4–WO_3 melt and exhibited the cubic reciprocal-lattice symmetry, O_h–m3m. Atomic parameters based on the best Im3m model and refined by the least-squares method are tabulated for X = 0.75. (C.J.G.)

9792

HEAT CAPACITY OF TERBIUM FROM 1.4 TO 4.0° KELVIN. R. M. Stanton, L. D. Jennings, and F. H. Spedding (Ames Lab., Ames, Iowa). J. Chem. Phys. 32, 630-1 (1960) Feb.

The heat capacity of terbium was measured from 1.4 to 4.0°K. A discussion of the anomaly at 2.4°K is presented. The magnetic heat capacity was calculated to be $C/R = 0.6 \times 10^{-2}T^{3}$. The lattice heat capacity at 4°K was calculated to be 14.2. (C.J.G.)

9793

OBSERVATIONS ON THE Fe–Cr–O SYSTEM. A. U. Seybolt (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 107, 147-56(1960) Mar.

An isothermal phase diagram for the Fe–Cr–O system is presented for 1300°C which, with a minor modification, holds for 1000°C. It is observed that Fe–Cr alloys containing over 13% Cr are in equilibrium with Cr_2O_3 containing a little dissolved Fe_2O_3. Alloys of lower chromium content are in equilibrium with iron chromite of variable composition of the type $FeCr_2O_4$. Evidence is presented indicating that when the spinel forms next to the metal a pronounced internal oxidation occurs. However, higher chromium alloys with Cr_2O_3 next to the metal show no tendency for internal oxidation. An oxygen pressure-composition diagram for the entire system is also presented. Marker experiments made during the oxidation of 20% Cr and 30% Cr alloys suggest that Cr_2O_3 is formed almost entirely by cation (Cr^{+3}) diffusion. (auth)

9794

STRUCTURAL ANOMALIES IN PLAIN-CARBON STEEL INGOTS ENHANCED BY HOT PLASTIC DEFORMATION. F. Borelli and G. Testero. Met. ital. 52, 1-7(1960) Jan. (In Italian)

On the surfaces as obtained by cutting or trimming steel plates with cold shears several irregularities are frequently noted which, at first, might be classified as slight interruptions in material's continuity. However it has been possible to ascertain that, among the said irregularities, there is a particular one in which there is no such discontinuity, it being instead a special micrographic structure caused by the segregation of non-metallic constituents. The technical means and necessary equipment (magnetic powders, ultrasonic testing) required for distinguishing the anomaly from true discontinuities are discussed. (auth)

9795

INCREASE OF THE STRENGTH OF TITANIUM BASE ALLOYS DURING COLD PLASTIC DEFORMATION. E. V. Petunina and V. L. Poplavskaya (Central Scientific Research Inst. of Ferrous Metallurgy). Metalloved. i Termichesk. Obrabotka Metal. No. 10, 24-7(1959) Oct. (In Russian)

Tests were carried out with titanium IMP-1A (technically pure Ti prepared by calcium hydride method) and IMP-7 (Ti alloy with 3% Al and 2% U) subjected to plastic

deformation. The specimens were annealed at 300, 350, and 400°C in order to determine the time and temperature effects. The strength limit with slightly lowered plasticity was reached at 20% deformation at which point the mechanical strength of IMP-1A increased from 67.8 to 90.8 kg/mm² and that of IMP-7 from 88 to 100.5 kg/mm². The sharpest drop in plasticity was observed at 10% deformation. The improved strength of the metal is retained at 300°C and it slowly weakens and acquires greater plasticity at 350 and 400°C. (R.V.J.)

9796

THE REACTION OF α-TITANIUM ALLOYS TO NOTCHING. V. I. Cherentsov. Metalloved. i Termichesk. Obrabotka Metal. No. 10, 27-32(1959) Oct. (In Russian)

The effects of notching, temperature, rate of deformation, oxygen, nitrogen and hydrogen content, and alloying materials, especially aluminum, on the fragility and mechanical properties of titanium were analyzed. It was found that titanium with 3 and 5% Al possesses good mechanical properties and can be used very effectively at room and low temperatures. It was also observed that aluminum increases the reaction of titanium to notching, and oxygen, nitrogen, and hydrogen affect it even more. To obtain tensile properties over 80 kg/mm² and conserve α structure, additional alloying with different metals is recommended. (R.V.J.)

9797

PROPERTIES OF SOME MANGANESE PHASE MAGNESIUM-BASE ALLOYS. M. E. Drits, Z. A. Sviderskaya, and L. L. Rokhlin (Metallurgical Inst.). Metalloved. i Termichesk. Obrabotka Metal. No. 10, 33-7 (1959) Oct. (In Russian)

A phase analysis based on selective dissolution of solid solutions was used for determining the nature of the manganese phase (1.5 to 2% Mn) in magnesium alloys (Mg–Mn, Mg–Mn–Al, Mg–Mn–Ca, and Mg–Mn–Al–Ca). The results show that magnesium does not diffuse in the manganese phase, aluminum diffuses in considerable quantities, and calcium diffuses only slightly. (R.V.J.)

9798

SOLUBILITY OF SOME TRANSITIONAL METALS IN ALUMINUM. V. M. Glazov, G. P. Lazarev, and G. A. Korol'kov (Kalinin Inst. of Non-ferrous Metals, Academy of Sciences, USSR). Metalloved. i Termichesk. Obrabotka Metal. No. 10, 48-50(1959) Oct. (In Russian)

The method of microhardness was used for determining the solubility of niobium, tantalum, and zirconium in aluminum at 640, 500, 450, and 350°C. It was found that niobium and tantalum and titanium and zirconium have practically identical curves of limited and maximum diffusion in aluminum and nearly identical factors of additional microhardness. (R.V.J.)

9799

TRANSFORMATION AND TREATMENT OF Ti AND ITS ALLOYS. A. A. Gol'denberg. Metalloved. i Termichesk. Obrabotka Metal. No. 10, 51-60(1959) Oct. (In Russian)

The effects of V and Nb on the structure and mechanical properties of binary titanium alloys at elevated temperatures were investigated. The data on recrystallization of titanium and its alloys and mechanical properties of aluminum–titanium–vanadium alloys were also analyzed. A high metal stability at elevated temperatures was achieved by alloying titanium with 8% Al, 8% Zr, and 1% Ta with cobalt (prolonged treatment at 590°C and short-time treatment at 870°C). Alloys with 6% Al, 1% V, and 4% Zr showed satisfactory mechanical properties at room and elevated temperatures. Alloying technically pure titanium (k = 0.36) with 6% Al increases the k factor to 0.44, and with simultaneous alloying with 8% Al and 4% Zr (or molybdenum), the k factor reaches 0.5, permitting operation at 430 to 680°C. (R.V.J.)

9800

THE INFLUENCE OF ALLOYING ELEMENTS ON THE ANNEALING PROCESSES IN STEEL. A. S. Zav'yalov and M. I. Senchenko. Metalloved. i Termichesk. Obrabotka Metal. No. 12, 2-11(1959) Dec. (In Russian)

The influence of titanium and niobium on annealing processes in steel, the variations of carbon concentrations in the α phase of annealed alloyed steel, and the effects of temperature and annealing time on the mechanical properties of steel with and without carbide-forming additives are analyzed. (R.V.J.)

9801

EFFECTS OF CREEP AT ELEVATED TEMPERATURE ON THE INTERNAL FRICTION AND MODULUS OF ELASTICITY IN METALS. I. A. Oding, M. G. Lozinskii, and L. K. Gordienko (Inst. of Metallurgy, Academy of Sciences, USSR). Metalloved. i Termichesk. Obrabotka Metal. No. 12, 24-31(1959) Dec. (In Russian)

The relationship between the structural changes taking place at various stages of creep and the changes in internal friction and modulus of elasticity was studied in technical iron and nickel–chromium alloy (69.6% Ni and 14.8% Cr) annealed at 950 and 1050°C, respectively. The iron was tested at 400°C and the Ni–Cr alloy at 750°C. (R.V.J.)

9802

NEUTRON DIFFRACTION STUDY OF ANTIFERROMAGNETIC SPIN WAVES IN α-FERRIC OXIDE. J. A. Goedkoop and T. Riste (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Nature 185, 450-2 (1960) Feb. 13.

Measurements of diffuse peak widths of antiferromagnetic α-Fe_2O_3 (hematite) near the (111) reflection (rhombohedral indices) were found to show a linear dependence. From the slope a spin-wave velocity of 3.76×10^6 cm/sec was deduced. A theoretical expression for the spin wave velocity was formulated. Data are included on the temperature variation of the antiferromagnetic (111) Bragg reflection. (C.H.)

9803

A NEW SILICON BORIDE, SiB_4. Carl F. Cline and Donald E. Sands (Univ. of California, Livermore). Nature 185, 456(1960) Feb. 13.

The fusion of SiB_6 and silicon yielded a new phase which occurred as rhombs and hexagonal plates. The crystals were reddish-brown under reflected light and had a measured density of 2.44 gm/cm³. Chemical and spectrographic analysis indicated the formula SiB_4. (C.H.)

9804

URANIUM MONOCARBIDE—FUEL OF THE FUTURE? F. A. Rough and R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Nucleonics 18, No. 3, 74-7(1960) Mar.

The following criteria were used in defining an ideal reactor fuel: (1) the thermal conductivity of a metal; (2) the high melting point of a ceramic; (3) the irradiation stability of UO_2; (4) the high uranium density of UO_2; and (5) the relatively low-cost of production. Using these criteria, uranium monocarbide may be said to be the reactor fuel of the future. In order for UC to be considered seriously for this role, the problems of violent reactivity with water, pyrophoricity, and thermal-stress cracking must be allowed for or eliminated. Materials-compatibility

studies show this monocarbide to be particularly suitable for sodium-, organic-, and high-temperature gas-cooled reactors. Its reactivity with water will probably rule out UC as a fuel for water-cooled reactors unless sufficient safeguards can be provided by design or cladding. A comparison of the properties of UC, UO_2, and uranium metal is presented in tabular form. The compatibility of UC with other materials is listed for temperatures up to 1200°C. An irradiation program was conducted to determine how UC was affected. (B.O.G.)

9805

ELECTRICAL RESISTIVITY OF YTTRIUM SINGLE CRYSTALS. P. M. Hall, S. Legvold, and F. H. Spedding (Ames Lab., Ames, Iowa). Phys. Rev. 116, 1446-7(1959) Dec. 15.

Two samples of yttrium cut from the same single crystal were used to determine the electrical resistivity parallel and perpendicular to the c-axis of the hexagonal close-packed metal. Measurements were made over the temperature range from 1.3 to 300°K. A large anisotropy was observed, with $\rho_\perp/\rho_\parallel = 2.1$ at room temperature. Values for the polycrystalline resistivity over the temperature range indicated were computed from these data and were found to fit a Grüneisen law with $\theta = 187.5$°K. The computed polycrystalline values were also in good agreement with the measured resistivity of a polycrystalline sample. (auth)

9806

MAGNETIC PROPERTIES OF HEMATITE SINGLE CRYSTALS. I. MAGNETIZATION ISOTHERMS, ANTIFERROMAGNETIC SUSCEPTIBILITY, AND WEAK FERROMAGNETISM OF A NATURAL CRYSTAL. S. T. Lin (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 116, 1447-52(1959) Dec. 15.

Two sets of magnetization isotherms of pure natural hematite single crystals from Elba were obtained in the temperature range from 488°K down to liquid helium temperatures. The first set of curves, along a certain direction in the basal plane, support Néel's magnetic model of a superposition of a weak ferromagnetism on a normal antiferromagnetism. The second set of curves, along the ternary axis, display very unusual form. The analysis of the isotherms shows that the antiferromagnetic susceptibility-temperature curves, $x - T$, are in good agreement with those obtained by Néel and Pauthenet but the weak ferromagnetic properties are apparently contradictory to their interpretations. The spontaneous magnetization-temperature curves, $\sigma_0 - T$, indicate that there is no isotropic ferromagnetism, and that the weak anisotropic ferromagnetism in the basal plane above transition and along the ternary axis below transition seems to have the same nature and origin. The $X - T$ and $\sigma_0 - T$ curves show that the wide transition takes place gradually and continuously. A general magnetic model of canted antiferromagnetism with unequal sublattice moments was proposed which explains all the experimental data satisfactorily. From the present model Haigh's data of remanent magnetization of hematite powder seems to be explained naturally. (auth)

9807

INTERPRETATION OF MAGNETIC PROPERTIES OF DYSPROSIUM. S. H. Liu, D. R. Behrendt, S. Legvold, and R. H. Good, Jr. (Ames Lab., Ames, Iowa). Phys. Rev. 116, 1464-8(1959) Dec. 15.

Dysprosium is ferromagnetic below 85°K, antiferromagnetic between 85 and 179°K, and paramagnetic above 179°K. The spontaneous magnetic moment lies always in the basal plane, and there is anisotropy in this plane below 110°K. It is shown that the magnetic properties can be interpreted in terms of a two-sublattice model and a phenomenological theory similar to a theory proposed by Néel. Detailed agreement for the magnetization curves in the ferromagnetic and antiferromagnetic regions is obtained. (auth)

9808

FARADAY EFFECT IN CERIUM PHOSPHATE GLASSES AT LOW TEMPERATURES. Perry B. Alers (U. S. Naval Research Lab., Washington, D. C.). Phys. Rev. 116, 1483(1959) Dec. 15.

The Faraday effect in glass specimens containing cerium metaphosphate in various concentrations was measured at 4.2 and 1.8°K, using 5461 A light, in magnetic fields ranging to 70 kilogauss. The curves of rotation vs H/T were fitted to the Brillouin function for $J = \frac{1}{2}$, yielding values of $g = 1.75$ and $\beta = 0.874$ Bohr magneton. The observed rotations were quite large; for the glass containing the highest concentration of cerium, the rotation approached a saturation value of 4.76π radians/mm. (auth)

9809

CRYSTAL STRUCTURES OF COMPOUNDS OF URANIUM WITH GERMANIUM. E. S. Makarov and V. N. Bykov. Soviet Phys.—Cryst. 4, 164-6(1960) Feb.

The symmetry and unit cell dimensions of the compounds U_5Ge_3, U_3Ge_4, and UGe_2 were determined from x-ray photographs. It was found that U_5Ge_3 has a hexagonal structure of the Mn_5Si_3 type with $a = 8.56$, $c = 5.78$ kX, and $c/a = 0.675$. The space group is D^3_{6h}—C6/mcm and the atomic parameters are $x_U = 0.24$ and $X_{Ge} = 0.62$. The compound U_3Ge_4 exhibited an orthorhombic cell of dimensions $a = 5.86$, $b = 9.86$, and $c = 8.96$ kX. The space group is D^{17}_{2h}—C mcm and the structure is of the $ZrSi_2$ type. The compound UGe_2 exhibited a cubic structure of the $AuCu_3$ type with $a = 4.197$ kX. (C.J.G.)

9810

DEVELOPMENT OF OXIDATION- AND LIQUID-SODIUM-RESISTANT BRAZING ALLOYS. D. Canonico and H. Schwartzbart (Lehigh Univ., Bethlehem, Penna. and Illinois Inst. of Tech., Chicago). Welding J. (N.Y.) 39, 122-8-s(1960) Mar.

A program is reported which had as its objective the development of filler alloys for brazing 310 stainless steel to Inconel at temperatures between 1750 and 1900°F, the joints to be resistant to oxidation and attack by molten sodium at 1650°F. Three metals—iron, chromium, and nickel—were selected from oxidation- and sodium-resistance considerations as the base metals from which to develop acceptable brazing alloys. From a study of all the available pertinent phase diagrams, 91 alloys were evaluated, of which 16 satisfied the flow-temperature and flowability requirements of the program. T-specimens brazed with these 16 alloys were subjected to an oxidizing atmosphere for 500 hours at 1650°F. Four alloys successfully withstood oxidation to a depth of less than 0.003 in.; these contained nickel, chromium, and germanium, and, in some cases, lithium. A nickel-chromium-silicon-indium alloy also showed promise but did not quite meet the oxidation-resistance requirement. The erosion characteristics and room-temperature shear strengths were also investigated. (auth)

9811

THE ACTIVITY OF SODIUM IN MOLTEN SODIUM-ZINC ALLOYS AT 600°C. Walter Hfusler (Technische Hoch-

schule, Vienna). Z. Metallk. 51, 95-100(1960) Feb. (In German)

The activities of sodium in sodium–zinc melts up to 2.5 per cent sodium are determined at 600°C by quantitative thermal analysis after W. Oelsen. The method is described and the results are discussed. (auth)

9812

RESEARCH ON GRAIN-BOUNDARY MIGRATION IN ALUMINUM BICRYSTALS. Wilhelm in der Schmitten, Peter Haasen, and Frank Haessner (Universität, Göttingen, Ger.). Z. Metallk. 51, 101-8(1960) Feb. (In German)

The activation energy of grain boundary migration has been determined to be 23 kcal/mol for single crystalline aluminum wires and 44 kcal/mol for polycrystalline wires. Herewith a model is confirmed after which the upper limit is given by lattice self diffusion, the lower limit by grain boundary self diffusion. The dependence of the migration speed of grain boundaries on the thickness of the specimen is discussed. (auth)

Radiation Effects

9813 CF-59-6-35

Oak Ridge National Lab., Tenn.

CALCULATIONS FOR IRRADIATION OF NATURAL UO_2–ThO_2 (REVISED). J. W. Ullmann. June 8, 1959. 6p. OTS

Calculations are given for eighteen stainless steel clad helium bonded specimens of UO_2–ThO_2 containing normal U to be placed in 6 holes in a holder in a position of the ORR not to exceed a peak unperturbed flux of 4×10^{14} n/cm^2/sec and irradiated to a peak nvt of 1.96×10^{21} neutrons/cm^2. (auth)

9814 CRMet-870

International Nickel Co., Inc., [New York].

THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF INCONEL "X" AND INCONEL NICKEL–CHROMIUM ALLOYS. C. R. Cupp. Sept. 1959. 54p. (AECL-948). AECL.

Tensile specimens of Inconel "X," age-hardenable nickel-chromium alloy, and of Inconel nickel-chromium alloy, in several metallurgical conditions (solution heat treated, mill annealed, cold drawn 35%) were irradiated at 50, 250, and 300°C, with integrated fast neutron fluxes of 1.3×10^{20}, 3.1×10^{19}, and 7.5×10^{19} n/cm^2, respectively. Room-temperature tensile tests of specimens irradiated at 50°C showed that the proportional limit and yield strength of annealed structures were considerably increased, while the cold-drawn specimens were much less affected. There was a relatively small (10 to 20%) increase in the ultimate tensile strength of all specimens, accompanied by a 25 to 40% decrease in per cent total elongation. Property changes in the specimens irradiated at higher temperatures were not as great and results indicate that saturation occurs after about 3.1×10^{19} n/cm^2. A slight yield point was observed in irradiated annealed (or solution treated) Inconel "X" alloy. This was more marked in the cold-drawn condition and well-developed in cold-drawn Inconel alloy. Recovery of mechanical property changes in annealed material irradiated at 50°C was not completed in one hour at temperatures below 600°C, at which temperature ageing had already started in unirradiated controls. Recovery started at 200° and continued gradually to 600°C. There was no evidence of ageing, during the postirradiation anneals, in the irradiated specimens prior to that in the unirradiated controls. Considerable recovery during irradiation at the elevated temperatures was suggested by the properties reaching constant values at fairly low flux levels. There was no evidence to suggest radiation enhanced ageing under any test conditions. There was no recovery of cold work in Inconel "X" alloy on irradiation at 250°C. (auth)

9815 GA-914

General Atomic Div., General Dynamics Corp., San Diego, Calif.

EFFECTS OF RADIATION ON METAL-CLAD GRAPHITE IN HIGH-TEMPERATURE, HIGH-PRESSURE CO_2. W. L. Kosiba. Nov. 19, 1959. 26p. Contract AT(04-3)-187. OTS.

Graphite specimens, clad with Inconel and Type 310 and Type 446 stainless steels, were encased in a stainless steel tube containing a CO_2 atmosphere and irradiated at 1500°F and 1000 psi. Radiation effects on the graphite specimens were studied by metallographic examinations and microhardness, dimensional, and weight measurements. Corrosion of all the cladding materials by CO_2 took place in both the presence and absence of radiation. Larger weight changes were noted for the irradiated specimens. Dimensional changes were not significant except where low pressures were used (diameter expansion of 2 to 6% resulted). Gas analyses indicated that radiation promotes the dissociation of CO_2, creating a more corrosive atmosphere. Very little or no carburization was observed at the cladding–graphite interface at 1500°F and 1000 psi either in the presence or absence of radiation. (C.J.G.)

9816 HW-61142

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

IRRADIATION TESTING OF PLUTONIUM–URANIUM OXIDE NUCLEAR FUEL. J. L. Bates and W. E. Roake. July 22, 1959. 21p. Contract AT(45-1)-1350. OTS.

Plutonium-enriched, uranium dioxide powder fuel generated more than 725 watts per gram of fissile atoms in a water-cooled, Zircaloy-clad, rod bundle test element. Local surface heat fluxes exceeded 400,000 Btu/hr sq ft. The relatively uncomplicated enclosing of fissile powder, as in this test element, represents an appealing method of manufacture of fuel elements containing difficult to handle materials such as plutonium. In-reactor sintering caused redistribution of the fissile powder to form long, unfractured compacts with large central voids. These sintered compacts were notable for the long, radially oriented, columnar grains of which they were principally composed. Characteristic small voids, similar to those observed in UO_2 dendrites formed from the vapor phase, were observed. Metallographic examination of etched surfaces of the irradiated fuel revealed etch pits on the single crystals. A second phase of undetermined composition was observed within the large grains. (auth)

9817 HW-61287

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN EFFECT OF NEUTRON FLUX LEVEL UPON DAMAGE ACCUMULATION. D. L. Gray. July 30, 1959. 7p. Contract AT(45-1)-1350. OTS.

Information is presented on the relationship between the properties and behavior of an irradiated metal and the neutron flux as well as the irradiation temperature. It is shown that whenever thermal recovery from radiation damage occurs during irradiation, the damage vs. nvt curves obtained for a given temperature are not equivalent for various flux levels. (J.R.D.)

9818 NAA-SR-Memo-4631

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EFFECTS OF RADIATION ON MASSIVE URANIUM MONO-

CARBIDE. H. Pearlman. Dec. 1, 1959. 16p. Contract AT-11-1-GEN-8. OTS.

This paper was presented at the "Symposium on Effects of Irradiation on Fuel and Fuel Elements," Metallurgical Society of AIME, Chicago, Ill., Nov. 4, 1959.

Samples of 8.3% enriched arc-melted and cast uranium monocarbide, 3/8 in. in diameter by 2 in. long, have been irradiated in instrumented capsules in the Materials Testing Reactor (MTR), at temperatures in the range from 1000 to 1830°F, to burnups from 1500 to 14,000 Mwd/T. Excellent compatibility was observed in Type 304 stainless steel containers, in which eutectic NaK was the bond material. Slight cracking, but no crumbling, of the monocarbide samples occurred. Density decreases for the longer irradiations were between 1.0 and 2.5% per atom per cent burnup, attributable principally to impenetrable cracks. Dimensional changes on intact samples were negligible. Fission gas release corresponded roughly to estimated surface recoil. In the four irradiations completed to date, carbon content ranged between 4.6 and 5.3 wt.%. Additional irradiations are in progress. (auth)

9819 NAMC-AML-AE-1089

Naval Air Material Center, Philadelphia.

STUDIES OF ORGANIC COATINGS EXPOSED TO GAMMA RADIATION. Jack Ohr. July 2, 1959. 16p. (AD-225022).

Twenty experimental and specification aircraft coating systems were exposed to 1.2 mev gamma radiation. Periodic examinations were made for changes in color and film properties. Many coating systems show significant degradation changes in color and film properties after exposures of only 8.0×10^7 roentgens. The radiation stability of the various coatings is explained in terms of polymer structure and chemical groupings. (auth)

9820 NP-8422

Southwest Research Inst., San Antonio.

MULTIKILOCURIE RADIATION EFFECTS FACILITY. [1960?]. 10p.

A description is given of a hot cell facility which uses a gamma flux source of 8400 c of 45 plus curies per gram specific activity Co^{60}. Usable gamma flux fields up to 2 or 3×10^7 r/hr can be obtained. (C.J.G.)

9821 NYO-7396

Canisius Coll., Buffalo.

INVESTIGATIONS IN IRRADIATED VITREOUS SILICA. Period covered: March 2, 1959–March 1, 1960. Herman A. Szymanski and David Keiffer. Mar. 1960. 26p. Included is a paper 1: COLOR CENTERS IN ALUMINUM OXIDE. Herman A. Szymanski, J. Durkin, and E. Dowling. Contract AT(30-1)-1810. OTS.

Information to be presented in journal articles covering the work performed during the report period are summarized. Research on color centers in aluminum oxide, kinetics of pressure-induced radiation damage, and calculations related to kinetics of irradiation-damaged vitreous silica using a 650 computer are described. A proposal for further research is also given. (J.R.D.)

9822 RIA-59-2056

Rock Island Arsenal Lab., Ill.

GAMMA RADIATION OF PACKAGING MATERIALS. W. F. Garland. July 31, 1959. 19p. DA Project No. 593-32-001.

The results obtained from exposing ten barrier materials or component parts over a dose range of 1.4×10^6 to 30.1×10^6 rad are summarized. Spent reactor fuel elements were used as the source of gamma radiation. The study was of an exploratory nature. Although all materials were degraded somewhat by the highest dose of radiation, the plastic films seemed to be the least affected. Among the materials evaluated, cotton scrim was the poorest of the materials, losing approximately 60% tensile strength at 30.1×10^6 rad. (auth)

9823 HW-tr-10

EFFECTS OF FAST NEUTRONS ON SOME PHYSICAL CONSTANTS OF CRYSTALLINE QUARTZ AND VITREOUS SILICA. G. Mayer and J. Gigon. Translated by Liz Appleby (Hanford Atomic Products Operation) from J. phys. radium 18, 109-14(1956). 16p. OTS.

The radiation effects of fast neutrons (2.5×10^{11} neutrons/cm^2/sec) on the expansion, the piezoelectric constant, and the elastic constants of quartz and silica were studied. The methods of measurement are discussed, and the results are compared with data reported by other authors. (C.J.G.)

9824

EFFECTS OF GASES ON IRRADIATED POLYVINYL CHLORIDE AS STUDIED BY ELECTRON SPIN RESONANCE. Zenichiro Kuri, Hisashi Ueda, and Shoji Shida (Japanese Ass'n. for Radiation Research on Polymers, Tokyo). J. Chem. Phys. 32, 371-4(1960) Feb.

The radicals produced by gamma irradiation of polyvinyl chloride powder in various gases and in vacuum are observed by electron spin resonance. Different patterns are observed for the irradiation in vacuum, air, and sulfur dioxide. No electron spin resonance absorption is obtained by the irradiation in nitrogen oxide, halogens, and hydrogen sulfide. The recombination reaction velocity of the radical produced in vacuum is measured at different temperatures to get the activation energy 38 kcal/mole. (auth)

9825

THERMAL STRESSES DUE TO GAMMA IRRADIATION. M. J. Hillier (Enfield Technical Coll., Eng.). Nuclear Power 5, No. 46, 128-30(1960) Feb.

Expressions were derived and calculations made on a first approximation to the peak tensile stress due to gamma irradiation in an ironplate, given an estimate of gamma-ray energy incident upon one face. (C.J.G.)

9826

RADIATION DAMAGE IN MATERIALS. A. H. Cottrell (Cambridge Univ., Eng.). Nuclear Power 5, No. 46, 130-1 (1960) Feb.

A theory of radiation growth is presented which makes use of stresses surrounding a fission spike. The theory considers the sudden heating of a small rectangular prism of α-uranium by a fission spike which is expected to result in expansion along the a- and c-axes and contraction along the b-axis. Due to the stresses in the fission spike, a strong inducement to counteract the b-axis shrinkage by shifting atoms to make more b-layers takes place at the expense of the number of atoms which form a- and c-layers. If such a rearrangement can occur during the heating phase of the fission spike and not occur in reverse during the cooling phase, the crystal will expand along the b-axis and shrink along the other axes. If the process occurs in a perfect region of the crystal, recrystallization to the original arrangement is expected to take place. Considering this theory, the rate of growth should be faster in imperfect (cold-worked) crystals than in more perfect ones. (C.J.G.)

9827

RADIATION MAKES BETTER WOODS AND COPOLYMERS. Vladimir L. Karpov and Yuri M Malinsky (Karpov Inst. of Physical Chemistry, Moscow); Vasili I. Serenkov and Raisa S. Klimanova (Research Inst. of Plastics, Moscow);

and Anatoli S. Freidin (Research Inst. of Mechanical Treatment of Wood, Archangelsk, USSR). Nucleonics 18, No. 3, 88-90(1960) Mar.

A study was made of the radiation effects on polymer-treated wood. The wood was soaked in mixtures of polyethylene and polystyrene and irradiated at doses up to 5×10^8 r/hr. Following irradiation, the wood was tested for resistance to compression, splitting, and static bending and compared to similar tests on unirradiated wood. The results are included. (B.O.G.)

9828

DISLOCATION LOOPS IN NEUTRON-IRRADIATED COPPER. J. Silcox and P. B. Hirsch (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 4, 1356-74(1959) Dec.

Electron transmission microscope observations were carried out on copper irradiated with neutrons at temperatures of 35°C and 60 to 100°C, and subsequently thinned by electropolishing. Specimens irradiated to a dose of 6.7×10^{17} cm^{-2} (at 35°C) contain $\sim 3 \times 10^{15}$ defects c.c.$^{-1}$ in the form of small regions of strain (average diameter ~ 75 A), some of which can be resolved as dislocation loops. With increasing dose of irradiation (5.6×10^{18}, 1.4×10^{20} n cm^{-2}) many more of the defects can be recognized as loops, and their average diameter increases to ~150 and ~300A, respectively. The dislocation density in the form of loops is 10^{10} to 10^{11} cm^{-2}. The stability of the loops and their behavior on annealing are as expected from prismatic loops. The loops are considered to nucleate as a result of the collapse of discs of vacancies produced by vacancy clustering in the central region of a displacement spike, and to grow by migration of vacancies or of vacancy clusters. Radiation hardening is interpreted in terms of the large density of dislocations in the form of loops. The hardening anneals out at the same temperature at which the loops are observed to disappear by climb. (auth)

9829

X-RAY EXPANSION AND COLORATION OF UNDOPED AND IMPURITY-DOPED NaCl CRYSTALS. Herbert Rabin (U. S. Naval Research Lab., Washington, D. C.). Phys. Rev. 116, 1381-9(1959) Dec. 15.

Expansion and coloration measurements of undoped and impurity-doped single crystals of NaCl were made under x-ray irradiation (43 kvp and 20 ma) for intervals up to three hours. Expansion was measured in a direction normal to the x-ray beam with a sensitive capacitive dilatometer that was designed to compensate automatically for thermal fluctuations. It was found that the initial rate of creation of F centers exceeds the rate of creation of vacancy pairs as computed from the expansion data; after continued irradiation the rates of F-center and vacancy-pair production are approximately evenly matched. This suggests that the initial production of F centers results from both vacancies originally contained in the crystal and vacancies created during irradiation, while the later coloration is due essentially to vacancies that are created in the irradiation process. Within the framework of this interpretation it is possible to estimate the initial negative-ion vacancy concentration of a number of crystals. This concentration ranges from 1×10^{16}/cm^3 for a Harshaw crystal to a value larger than 6×10^{17}/cm^3 for a calcium-doped crystal grown at NRL. Although the presence of a large initial concentration of negative-ion vacancies in calcium-doped NaCl explains its enhanced color sensitivity to x-rays without a corresponding enhancement of x-ray-induced expansion, this explanation is not in accord with simple expectations of charge compensation and the law of mass action. (auth)

9830

X-RAY INDUCED ELECTRICAL POLARIZATION IN GLASS. T. M. Proctor (Corning Glass Works, Corning, N. Y.). Phys. Rev. 116, 1436-40(1959) Dec. 15.

Electrical polarization in a lead silicate glass induced by the action of x-rays on the material is found to exist. This phenomenon is surveyed experimentally as a function of total dose (incident and absorbed), dose rate, x-ray tube potential, radiation temperature, and temperature at which the polarization is released and measured. Net surface charges of the order of 10^{-9} coulomb/cm^2 can be obtained from 3-mm thick samples irradiated at room temperature with 10^5 r of 250-kv x-rays. To the first order the build-up and decay of this condition seems to follow the normal electrical relaxation as can be theoretically predicted from the dielectric and resistivity constants of the material ($\tau = \rho\epsilon$). Measured surface charge is shown to be proportional to absorbed dose for smaller doses; for greater doses final equilibrium in the polarization is reached when back electrical conduction becomes as large as the forward x-ray induced displacement current. The dependence of measured surface charge upon the sample thickness was experimentally investigated for one case. (auth)

PHYSICS

General and Miscellaneous

9831 AD-157600

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. PHOTOLUMINESCENT DOSIMETRY WITH PLASTICS AND PLASTIC PHOSPHORS (thesis). Donald Alexander Ramsay. Feb. 1958. 58p.

Two plastics, polystyrene and Plexiglas, and two plastic phosphors, NE 102 and Sintilon, were studied for possible use in dosimetry. The photoluminescence of gamma irradiated samples was compared to that of unexposed samples. The range of doses was up to 10^8 r. The NE 102 indicated the best promise for practical use. This material emits 4330 A light under 3570 A excitation and is stable up to 5×10^6 r beyond which its emission degrades with increased dose. The Sintilon emits 4400 A light under 3625 A excitation. This emission is somewhat irregular for doses less than 10^5 roentgens but degrades gradually for larger doses. The plastics do not emit under ultraviolet light and are not satisfactory for use in dosimetry. Some mechanisms of radiation damage to polymers are discussed. (auth)

9832 AECU-4661

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 to 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Progress Report No. 15 [for] September 1 to December 1, 1959. P. D. Coleman, W. L. Emery, A. W. Swago, C. Enderby, R. J. Kenyon, J. J. Stafford, B. W. Hakki, and J. R. Baird. Jan. 1, 1960. 61p. Contract AT(11-1)-392. OTS.

The work thus far on gas discharge frequency multipliers has been mainly experimental with the program being guided by largely qualitative ideas. A first order theory was developed which predicts quantitatively many of the results of the past experiments. While it is not known as yet if the analysis is correct in all respects, it should serve as a guide in future experiments. Experimental work was continued on a series of 8 mm, CW, multiplier experi-

ments and some new 3 cm pulsed, multiplier experiments. In the X-band experiments, a new multiplier geometry was tried where the gas discharge was maintained by a d-c source. With this arrangement, the RF drive power requirements were substantially reduced. The study of dipolar modes in ferrites leads to consideration of the dual problem of the polarization modes in a plasma column in a B_z field. The characteristic equation determining the resonant frequency of these polarization modes was derived. The work on ferroelectrics was concentrated on the analysis and development of a measurement scheme for the evaluation of material properties. A program for evaluation of the 140 to 220 kmc/s components was finalized. (For preceding period see AECU-4458.) (W.D.M.)

9833 AECU-4676

Ohio State Univ. Research Foundation, Columbus.

LOW ENERGY NUCLEAR PHYSICS. Second Annual Report for the Period February 1, 1959 to January 31, 1960. Philip S. Jastram. Jan. 23, 1960. 122p. Contract AT(11-1)-605. OTS.

The general expression for the angular correlation between radiations produced in successive cascade transitions is derived by use of Racah algebra. The result is then specialized to the $\beta-\gamma$ correlation and applied to two cases in which additional properties of the photon are specified, the circular polarization and the plane polarization. The prospect of testing time reversal and determining nuclear matrix element ratios by $\beta-\gamma$ correlation measurements is explored using the nuclide Tm^{170} as an example. The directional angular correlation between the 2.31-Mev beta and the subsequent 0.605-Mev gamma emitted in the decay of Sb^{124} was measured as a function of the beta energy. The K-conversion coefficient of the 279-kev gamma following beta decay of Hg^{203} was measured by comparing the x-ray and gamma intensities in a scintillation spectrometer. The measured valve of $\alpha_k = 0.195 \pm 0.014$ indicates that the transition is M1 with E2 mixed to the extent of 63%. The angular correlation of the 107–1.24 Mev gamma cascade in Zn^{68} following the decay of 68-min Ga^{68} is shown. The Legendre polynomial expansion coefficients were determined to be $A_2 = 0.31 \pm 0.03$ and $A_4 = 0.23 \pm 0.07$. The angular correlation in the decay of Sb^{118} was studied between the 1.03–1.22 Mev gammas and between the 0.260–1.22 Mev gammas in an attempt to deduce the spins of the corresponding levels of Sn^{118}. Apparatus: A linear amplifier employing triode pairs connected in cascade and R-C clipping was designed for applications to scintillation and proportional counter gamma and x-ray spectroscopy in the kilovolt region. The circuit design and performance are described. A wideband distributed amplifier which uses twelve 6688/E180F pentodes is described. Design, construction, and performance details are discussed. A thin-lens beta spectrometer designed particularly for $\beta-\gamma$ coincidence spectroscopy and angular correlation measurements was constructed. (W.D.M.)

9834 ATL-A-101

Advanced Technology Labs. Div. of American-Standard, Mountain View, Calif.

RBU: A COMBINED MONTE CARLO REACTOR-BURNUP PROGRAM FOR THE IBM 709. ATL Job C-13. E. J. Leshan, J. R. Burr, M. Temme, G. T. Thompson, and J. R. Triplett. Sept. 30, 1959. 248p. Contract AT(04-3)-109. OTS.

RBU is a digital computer program for the detailed calculation of the neutron, reactivity, and isotopic history of a reactor in which relatively exact models of the geometry and physical processes are included to permit reliable predictions of fuel costs and reactor performance. The program uses the Monte Carlo method to obtain the fine structure of the neutron flux in three space dimensions and energy. Using this fine structure, cross sections are averaged over space and energy to obtain the neutronic properties for equivalent homogeneous one-dimensional regions of space and ranges of energy. These are used in diffusion calculations to obtain the macroscopic flux distribution throughout the reactor. The consumption and production of isotopes is computed for a time step by the solution of sets of partial differential equations involving both the macroscopic and microscopic fluxes. With the new concentrations, diffusion calculations are performed again to obtain macroscopic fluxes for the next time step. At variable intervals, Monte Carlo calculations are again performed to determine the changes in microscopic flux distributions. The cycle is repeated until conditions on the reactivity or other properties dictate the end of the calculation. Programmed control rod manipulation may be included in the calculation. The Monte Carlo, diffusion, or burnup portions of the program may be used separately. The unresolved resonance range is treated by random selection of resonance parameters from appropriate distributions using the Doppler broadened single level Breit-Wigner formula. Resolved resonances are treated similarly with the exception that specific values of the resonance parameters are used. The effects of molecular binding and thermal motion of the nuclei on near-thermal scattering are treated by a simple model capable of incorporating the pertinent physical theory and data. (auth)

9835 CEA-1111

France. Commissariat à l'Énergie Atomique, Paris.

ETUDES EXPERIMENTALES SUR LE RAYONNEMENT X D'UNE DECHARGE ANNULAIRE A FORTE INTENSITE. (Experimental Studies on the X-Radiation from a High-Intensity Annular Discharge). C. Etievant. Feb. 1959. 9p.

Under certain conditions, a very penetrating x radiation is emitted at the start of a stabilized annular discharge. A number of experimental observations have been made using a pyrex toroid filled with deuterium or argon. The value of the stabilizing magnetic field and the pressure have a very important influence on the intensity of the x-radiation emitted. The placing of an obstacle such as a magnetic mirror at a point of the torus can prevent the acceleration of runaway electrons during successive revolutions, and x-ray emission disappears. (auth)

9836 CWLR-2353

Chemical Warfare Labs., Army Chemical Center, Md.

THERMAL ATTENUATION BY CHEMICAL SMOKES. Jerry J. Mahoney, Douglas D. Keough, and David T. Kilminster. Jan. 1960. 28p.

An investigation was made of the thermal radiation protection afforded by smokes in the case of nuclear detonations. The transmissivity of thermal radiation was measured for six types of smoke. The smokes tested included fog oil, naphthalene, titanium tetrachloride, chlorosulfonic acid–sulfur trioxide, hexachloroethane, and silicon tetrachloride–ammonia. From the results of the experiments it was concluded that an absorbing smoke, such as naphthalene, is much more effective than a scattering smoke in reducing thermal radiation from a 6000°K source, when smoke concentrations of 0.5 gm/sq mi (384 gal/sq mi) are used. Data for the separate smokes are presented graphically. (C.H.)

9837 NAA-SR-4238

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EXPONENTIAL EXPERIMENT WITH A THORIUM–URANIUM FUEL IN GRAPHITE. C. H. Skeen, G. L. Blackshaw, and W. W. Brown. Mar. 1, 1960. 25p. Contract AT-11-1-GEN-8. OTS.

An exponential experiment with multirod fuel elements in graphite moderator is described. The fuel is a thorium–uranium alloy. The buckling, thermal utilization, and resonance escape probability for one lattice configuration have been measured. In the analysis, emphasis is placed on determining the effective resonance integral of the fuel element. From the measured resonance escape probability, 0.856 ± 0.008, an integral (including 1/v capture) of 9.7 ± 0.8 barns is obtained. From the measured buckling (10.89 ± 0.05 m^{-2}) and thermal utilization (0.9445 ± 0.0009) a value of 11 ± 2 barns is obtained for the integral. Although in agreement with one another, these values are not in general agreement with either calculated values or the results inferred from other measurements. (auth)

9838 NASA-TN-D-266

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

ANALYSIS OF ONE-DIMENSIONAL ION ROCKET WITH GRID NEUTRALIZATION. Harold Mirels and Burt M. Rosenbaum. Mar. 1960. 44p. OTS.

A one-dimensional analysis is made of an ion rocket employing grid neutralization. The rocket consists of a grid that emits ions, a grid that accelerates the ions, and a grid that decelerates the ions and neutralizes them (by the emission of electrons). The ion beam between the ion-emitting grid and the neutralization grid is determined, as is the mixed ion-electron beam downstream (and sometimes, upstream) of the neutralization grid. The mixed ion-electron beam is found to have a small-wavelength, small-amplitude periodic wave structure. The forces on the individual grids and the over-all thrust of the ion rocket are also determined using momentum-integral concepts. (auth)

9839 NP-8338

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 35. Jan. 15, 1960. 73p. Contract Nonr-1841(34).

The problem of transition group elements in crystalline fields is treated. A general outline is given of the method of investigating multiplet splitting in a crystalline field, which is developed in close analogy to that used in individual atoms. Full account is taken of the generality which would be found in a non-central field, where one may not assume separable one-electron wave functions. Closely related problems concerning the effect of crystalline fields on atomic wave functions and form factors, are treated. A study was made of the wave function of atomic beryllium by the method of configuration interaction. Progress is reported on programs which have not been completed including molecular integrals, general methods of programming, calculations on iron bands, energy bands, the linear chain, and trapping of holes in alkali halides. (For preceding period see NP-8042.) (W.D.M.)

9840 NP-8407

New York Univ., New York.

RESEARCH ON SOLID STATE RADIATION-INDUCED PHENOMENA. Quarterly Progress Report No. 7 for August, September, October. Hartmut Kallmann. Dec. 1959. 36p. Contract DA-36-039-SC-75043.

Quenchers of fluorescence in solutions under high energy excitation decrease the light output more by their decreasing of energy transfer than upon direct action upon the solute. In contrast to the energy transfer in an unquenched solution when a quencher is present there is a considerable dependence on the solute. From theoretical considerations a straight line dependence on quencher concentration is expected for the inverse intensity if the solute effect is negligible. This behavior is found in the experiments. However, the quantitative prediction of quenching on solute concentration does not agree with the theory if a constant energy transfer parameter is assumed. It is found also that "naphthalene" solutions are somewhat less quenched than xylene solutions. The behavior of ZnS and CdS manganese activated phosphors was studied under the application of DC and AC fields with ultraviolet and x-ray excitation. In nearly all cases a DC field caused transient increases or decreases while the AC field produced permanent increases of light emission. The permanent light increase in the case of AC field and x-ray excitation was for the most part under 30%, although for one sample it was 100% and for another up to 600%. Equipment to measure the variation with temperature and concentration of the fluorescence of organic solutions is being built and calibrated. It is hoped that the manner in which the fluorescence varies with changing parameters will indicate the mechanism of energy transfer from solvent to solute. The equipment built so far comprises: electrometer circuitry; the multiplier phototube circuit; the vessels to contain the solutions; and part of the heating unit. A preliminary calibration has been made of the multiplier phototube response as it varies with light input. (For preceding period see NP-8087.) (auth)

9841 UCRL-8928

California. Univ., Berkeley. Lawrence Radiation Lab.

THE FABRICATION OF RADIOACTIVE SOURCES. Albert E. Salo and Nelson B. Garden (with Appendix by Herbert P. Cantelow). Oct. 1959. 31p. Contract W-7405-eng-48. OTS.

Techniques and arts used in preparing alpha, beta, and gamma radiation sources at Lawrence Radiation Laboratory are described. Methods for securing relatively swipe-free open sources as well as methods for sealing closed sources are outlined. Suggestions are given also for leak testing, shielding, and marking. The problem of source preparation is approached from a practical viewpoint, and theoretical aspects are discussed. (auth)

9842 UCRL-9017

California. Univ., Berkeley. Lawrence Radiation Lab.

PHYSICS DIVISION SEMIANNUAL REPORT [FOR] MAY THROUGH OCTOBER 1959. Dec. 10, 1959. 55p. Contract W-7405-eng-48. OTS.

Work by the various general physics research groups in the Laboratory is briefly summarized in terms of bubble chambers, strange particles, anti-particles, elementary particle reactions, accelerator studies, etc. Operation of the 60-inch cyclotron and the heavy-ion linear accelerator is discussed. (For preceding period see UCRL-8936.) (W.D.M.)

9843 WT-369

California. Univ., Berkeley.

THEORETICAL STUDIES OF UNDERGROUND SHOCK WAVES. C. B. Morrey, Jr., Edmund Pinney, R. G Stoneham, P. L. Chambre, R. M. Lakness, and Emanuel Parzen. Apr. 1952. Decl. Aug. 24, 1959. 169p. Project 1.9 [of] OPERATION JANGLE. OTS.

A theory of wave motion in the ground was developed in an attempt to account for phenomena already observed in large-scale explosions and as a means of predicting phenomena with reasonable accuracy in future explosions. A discussion is presented in support of the belief that the ground behaves like an elastic solid at distances from the explosion corresponding to values of the scaled distances

which are greater than 4. The most general possible relation between the stress tensor T and the strain tensor E is derived for an isotropic medium. A theory is developed of a hypothetical material whose mechanical behavior may approximate that of soil. Methods are presented for the exact formal solution for the displacements in an elastic half space due to any arbitrary radial pressure-time distribution on the surface of a small finite spherical cavity within the half space. A derivation is presented using methods of statistical mechanics of the equations of mass-motion of a medium which consists of a very large number of particles any two of which repel one another according to a given law of force. The assumptions underlying the theory of dimensional analysis are reviewed and the fundamental Vaschy-Buckingham Pi Theorem is stated. Application is made to the determination of the most general functional forms of the peak values of soil pressure, particle acceleration, velocity, and displacement. (C.H.)

9844 AEC-tr-3989
THE LAW OF THERMAL CONDUCTIVITY OF LIQUIDS AND VAPORS. A. K. Abas-zade. Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 60-7(1952). 12p. JCL or LC.

Thermal conductivities of water, benzene, toluene, and xylene (in both the liquid and the vapor state) were experimentally determined. It was shown that the relationship between thermal diffusion and the cube-root of the density of a given substance is a function of state (liquid or vapor). The experimental data showed the applicability and provided justification for the theoretical equation of Predvoditelev. (auth)

9845 AEC-tr-3990
CALCULATION AND MEASUREMENT OF THE THERMAL CONDUCTIVITY OF NITROGEN UP TO 13000°K. F. Burhorn. Translated for Oak Ridge National Lab. from Z. Physik 155, 42-58(1959). 43p. (Includes orig., 17p.). JCL.

The thermal conductivity of nitrogen up to 13,000°K was measured in a wall-stabilized, cylindrical arc of 5 mm diam and 100 amp current intensity by means of the temperature course which was determined according to six different spectroscopic methods. A comparison with the theoretical calculation of the thermal conductivity shows agreement on the existence of the high dissociative heat conduction. A high contribution of the ionization heat conduction was observed. The measurements provide a quantitative confirmation of the fact that the arc in nitrogen and in air at high current intensities produces a bright-white nucleus within the violet aureole. (auth)

9846 CEA-tr-A-555
PRÉCIS DE LA FORMATION DES IMAGES AU MICROSCOPE. I. LOIS DE LA FORMATION DES IMAGES EN OPTIQUE GÉOMÉTRIQUE. (Summary of the Formation of Images by the Microscope. I. Laws of Formation of Images in Optical Geometry). E[rnst] Abbe. Translated into French by R. Carbonnier from Chap. I, p.3-14 of "Die Lehre von der Bildentstehung im Mikroskop." 1910. Otto Lummer and Fritz Reiche, eds. 14p.

A geometric treatment is given which is divided into six parts: construction of a ray refracted by a spherical surface, image formation of any luminous point on the axis, image formation of luminous objects, image formation by a system of centered spherical surfaces, Abbe equations for image formation, and image formation by a beam of large aperture. (T.R.H.)

9847 CEA-tr-R-465
COMPRESSIBILITÉ DES ÉLÉMENTS EN FONCTION DU NUMÉRO ATOMIQUE. (Compressibility of the Elements as a Function of Atomic Number). L. F. Verechtchagin (Verechtchaguine) and A. I. Likhter. Translated into French from Doklady Akad. Nauk S.S.S.R. 86, 745-8(1952). 7p.

Compressibility of the elements versus atomic number was plotted for 1, 30,000, and 100,000 kg/cm^2 and discussed as to periodicity, and the elements at the maxima. To explain some findings, one must suppose that a rearrangement takes place in the electron shells. (T.R.H.)

9848 CEA-tr-R-773
LA PLATINE DU MICROSCOPE POUR LA MESURE DE LA DISPERSION DES PARTICULES DANS LES ÉMULSIONS PHOTOGRAPHIQUES NUCLÉAIRES. (A Microscope Stage for Measurement of Particle Scattering in Photographic Nuclear Emulsions). A. O. Vaisberg, V. A. Smirnitskii (Smirnitsky), and N. V. Rabin. Translated into French from Pribory i Tekh. Ekspt. 2, 112-17(1957). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 8624.

9849 CEA-tr-R-776
VÉRIFICATION EXPÉRIMENTALE DU COMPORTEMENT DES PARTICULES CHARGÉES DANS UN PIÈGE ADIABATIQUE. (Experimental Verification of the Behavior of Charged Particles in an Adiabatic Trap). S. N. Rodionov. Translated into French from Atomnaya Energ. 6, 623-9 (1959). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 18405.

9850 CEA-tr-R-784
CALCUL DES CHALEURS DIFFÉRENTIELLES D'ADSORPTION DE VAPEURS SUR LES CHARBONS ACTIFS. (Calculation of Differential Heat of Adsorption of Vapors on Activated Carbons). B. P. Bering, M. M. Dubinin (Doubinin), and V. V. Serpinskii (Serpinsky). Translated into French by B. De Trezvinsky from Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, No. 6, 981-8(1959). 17p.

The differential heat and entropy of adsorption equations are given for vapors on type-I adsorbents. For total differential heats of adsorption one must know the structure of the adsorbent and the saturated vapor pressure, molar volume, parachor, and thermal coefficient of volumetric expansion of the substance adsorbed. The methods are given for calculation of differential heats of alkanes on type-I adsorbents, which permit determination of values within 1% of a single characteristic and within the increments of structure for the latent heat of evaporation. (tr-auth)

9851 NP-tr-333
BENDING AND TORSION OF MULTICELL SHELL STRUCTURES. (Izgib i Kruchenie Mnogozamknutoi Kessonnoi Konstruktsii). I. F. Obraztsov. Translated from a publication of the Publishing House of the Defense Industry, Moscow, 1957. 73p. OTS.

An engineering method for analysis of a four-cell structure working in bending and torsion is given with consideration of additional strains due to stresses of deplantation. The influence of some geometric dimensions on the stressing of a cell is demonstrated, and formulas useful in practical analysis are derived. Experimental data are used to support theory. (J.R.D.)

9852 NP-tr-362
THE ESTIMATION OF PHYSICAL PROPERTIES BY MEANS OF UNIVERSALLY APPLICABLE METHODS OF CALCULATION. A. Lydersen. Translated by F. Hudswell (U.K.A.E.A. Atomic Energy Research Establishment) from Dechema Monograph 32, 39-45(1959). 8p. JCL.

Methods of approximating the physical properties of a material by the theorem of corresponding states are reviewed. (C.J.G.)

9853 T-304-R

SOME RESULTS OF RESEARCH WITH ARTIFICIAL EARTH-SATELLITES: INTENSITY OF COSMIC RADIATION. L. V. Kurnosova. STATE OF THE OUTER IONOSPHERE. Ya. L. Al'pert. Translated by F. R. Hope from Priroda 47, No. 6, 85-7(1958). 7p. (AD-207088). JCL.

The paper entitled Some Results of Research with Artificial Earth-Satellites: Intensity of Cosmic Radiation, by L. V. Kurnosova, was abstracted from the original language in NSA, Vol. 12, abstract No. 15635. The second paper gives an analysis of the state of the outer ionosphere based on artificial satellite data received by radio. Electron and neutral particle densities as a function of altitude are tabulated. (J.R.D.)

9854

STUDY OF LATTICE VIBRATIONS BY RESONANCE ABSORPTION OF NUCLEAR GAMMA RAYS. William M. Visscher (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. (N.Y.) 9, 194-210(1960) Feb.

It was demonstrated by Mössbauer that in a large proportion of emissions or absorptions of gamma rays by nuclei bound in crystals at low temperature the recoil energy is taken up by the crystal as a whole (no phonons are emitted). It is shown that an extension of Mössbauer's technique can be utilized to directly observe the frequency distribution of lattice vibrations in the crystal. Specifically, if the emitter and absorber have the same favorable crystal structure, then the self-absorption cross section observed in a rotor experiment at low temperature will be proportional to N(S)/S, where N(S) dS is the number of phonon states in an energy interval dS, and S is the doppler shift in the gamma-ray energy induced by the rotor motion. A résumé of some of Mössbauer's experimental results and the theory of Lamb which explains them is given. (auth)

9855

RESTRICTED AND UNRESTRICTED HARTREE-FOCK CALCULATIONS FOR ATOMIC LITHIUM. R. K. Nesbet (Boston Univ., Mass.) and R. E. Watson (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N.Y.) 9, 260-71 (1960) Feb.

The unsymmetrized unrestricted and several restricted versions of the Hartree-Fock formalism are used in calculations for atomic lithium. The calculations differ from each other only in the sixth decimal digit of energy except for the restricted case where $\chi = 0.5$. This suggests that it is advantageous to use a particularly tractable version of the restricted Hartree-Fock formalism. (auth)

9856

ELECTRON CONFIGURATION AND HYPERFINE STRUCTURE OF PLUTONIUM I. Simon Gerstenkorn (C.N.R.S., Bellevue, France and Commissariat à l'Énergie Atomique, Saclay, France). Compt. rend. 250, 825-7(1960) Feb. 1. (In French)

The precise measurement of the ratios of the intensities of the components of the hyperfine structure of the spectral rays of Pu I was made with a photoelectric Fabry-Perot spectrometer. The J values of about thirty levels of the Pu I spectrum were deduced, and these values led to the $5f^67s^2$ configuration for the fundamental term of Pu I. (tr-auth)

9857

ISOTOPIC DISPLACEMENTS IN THE SPECTRUM OF URANIUM. Michèle Diringer (C. N. R. S., Bellevue, France). Compt. rend. 250, 828-30(1960) Feb. 1. (In French)

A systematic study of the isotopic displacement in the arc spectrum of uranium is being made. Some of the results obtained are given. The spectrum was studied with a Fabry-Perot recording spectrometer with a hollow liquid nitrogen, neon, or argon source. The uranium was in the form of UO_3, usually enriched 21% in U^{235}. The isotopic displacements are tabulated in millikaysers (10^{-3} cm^{-1}). From the results obtained some observations were made on the electronic configurations of the odd terms. (J.S.R.)

9858

NEW METHOD TO MEASURE WITH PRECISION THE LENGTH OF THE RAYS OBTAINED DURING THE DIFFRACTION OF X RAYS BY CRYSTALLITE. Jean Trompette, Henri-Jean Latiere, and Odile Balique. Compt. rend. 250, 1022-4(1960) Feb. 8. (In French)

The relationship between the dimensions of crystallites and the length of the diffraction rays, measured by the angular distance which separates the two inflection points of the curve of intensity distribution as a function of the diffraction angle, was established. Three possibilities are considered according to whether the measurement is done directly on the beam of diffracted x rays or whether a film is used. (tr-auth)

9859

NUCLEAR EMULSIONS: STUDY AND FABRICATION OF A HETEROGENEOUS TARGET. Cl. Bovet (Université, Neuchâtel, Switzerland). Helv. Phys. Acta 32, 507-10 (1959). (In French)

A series of studies on reactions induced by 300- to 600-Mev neutrons on heavy nuclei has necessitated an improvement of the discrimination of nuclear emulsions and the fabrication of sandwich emulsions. The measurements which led to the choice of hydroquinone as the detector and the Ilford E-1 emulsion for the best discrimination are indicated. The fabrication of the heterogeneous target composed of a 2 micron gold foil between emulsion layers is briefly described. The sandwich emulsion has a cross section for star production equal to $\sigma = \frac{3}{4}\,\sigma_{geom.}$ or for gold $\sigma \approx 1.5$ b. A background flux of 10^6 neutrons/cm^2 is permissible. (J.S.R.)

9860

BETA-EXCITED CHARACTERISTIC X-RAYS AS ENERGY REFERENCE SOURCES. J. F. Cameron and J. R. Rhodes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 7, 244-50 (1960) Jan. (In English)

The β particles emitted from 1 mc of Kr^{85} sealed in a small nickel capsule were used to excite the characteristic k x rays of various elements. It was found that the best arrangement of source and target was with the source sandwiched between two thin foils of the target element. The use of these x rays as energy references for the calibration of proportional and scintillation counters in the energy region 0 to 100 keV is illustrated. Since the energies of k x rays are known to about one part in 10^4 the accuracy of calibration depends only on the resolution of the instrument under test. (auth)

9861

TEMPERATURE DAMPING OF ZnS–Ag PHOSPHOR CRYSTAL LUMINESCENCE IN EXCITATION BY LIGHT OR α PARTICLES. M. D. Galanin and A. V. Raevskiĭ (Lebedev Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1280-2(1959) Nov. (In Russian)

The effects of temperature on luminescence damping in ZnS–10^{-4} Ag phosphors calcined at 800°C were studied. Experimental curves of temperature damping were plotted for both Po^{210} α particle excitation and light (λ = 365 mμ) under constant and slowly changing thermal conditions. (R.V.J.)

9862

PHOTOELECTRIC PHENOMENA IN LUMINESCENCE POWDERS OF ZnS–Cu(Ni, Fe, Co) AND ZnS·CdS–Cu. U. Kh. Nymm (Tartu State Univ., Estonian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1286-9(1959) Nov. (In Russian)

The photoelectric phenomena in ZnS·CdS–Cu phosphors containing 45, 35, 25, 18, 8, and 0% CdS and ZnS–Cu (Ni, Fe, Co, ZnO) phosphors were investigated by a condenser method. The spectral and temperature relations were derived as functions of photoelectric response. The luminescence excitation spectrum and the curves of thermal de-excitation were measured for ZnS·CdS phosphors. (R.V.J.)

9863

PHOTOELECTRIC EFFECTS IN ZnS–Cu, Fe PHOSPHORS. P. E. Ramazanov (Kuĭbyshev Tomsk State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1290-3(1959) Nov. (In Russian)

The temperature dependence of photoelectric effects at various frequencies is correlated with the theoretical dependence in thermal ion displacement polarization. Fe(Cu, 10^{-4}; Fe, 10^{-5}) specimens were investigated and the temperature functions Δtg σ and $\Delta C/C_t$ (where C_t is the condenser dark space) were taken at 90.2 kHz, 2.94 MHz, and 9.69 MHz at equilibrium excitation and at various stages of phosphorescence damping. (R.V.J.)

9864

THE INFLUENCE OF COMPOSITION ON THE LUMINESCENCE OF NON-ACTIVATED ZnS·CdS PHOSPHORS. L. Drozd (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1300-3(1959) Nov. (In Russian)

Interactions of natural activators were studied in mixed ZnS·CdS phosphors with various contents of CdS (0; 0.01; 0.1; 0.3; 1; 5; 10; 15; 20; 50; 80; 90; 95; 99; 99.7; 99.99; and 100%). Crystals were fused with NaCl (2%) and calcined at 900°C for 15 min. The brightest luminescence was achieved with specimens calcined at 850 to 900°C in oxide media. (R.V.J.)

9865

PROPERTIES OF ZINC SILICATE CRYSTALS AND LUMINESCENCE OF ZINC SILICATE LUMINOPHORS ACTIVATED BY MANGANESE. V. V. Oseko (Lebedev Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1314-18(1959) Nov. (In Russian)

The influence of chemical composition and methods of preparation on the properties of zinc silicate luminophors activated by manganese was investigated. The luminophors were prepared by sintering zinc oxides and silica with additions of manganese nitrate. The concentration of Mn activator was within 1 wt.%. The compositions of sintered luminophors (20 hours at 1350°C) were analyzed, and Debye crystallograms were prepared. (R.V.J.)

9866

LUMINESCENCE CENTERS IN PHOSPHORS OF ZINC SULFIDES ACTIVATED BY SAMARIUM. Z. A. Trapeznikova (Lebedev Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1319-25 (1959) Nov. (In Russian)

The formation of luminescence centers in the case when the introduction of an activator is followed by the formation of anion and cation vacancies was investigated. Newly formed vacancies may appear near the activator ions, creating new luminescence centers. Also, an increased luminescence can be achieved by activator-ion pairing as a function of activator concentration. It was found that samarium can simultaneously form three or more types of luminescence centers with variant electron and vacancy captures depending on the samarium concentration and the preparation method. (R.V.J.)

9867

PHYSICO-CHEMICAL PROPERTIES OF SILVER ACTIVATOR IN A ZINC SULFIDE LUMINOPHOR. A. A. Cherpnev (Lebedev Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1334-40(1959) Nov. (In Russian)

The physico-chemical properties of a silver activator as a function of interactions between the components (ZnS, Ag_2S, Ag, Zn, ZnO, calcination, and atmosphere) during preparation were studied. Various compositions of ZnS–Ag were prepared at 800 to 1100°C with NaCl and H_3BO_3 flux, and their luminescence properties at λ = 365 mμ excitation at room temperature were analyzed. Absorption spectra were measured. (R.V.J.)

9868

THRESHOLD LAW FOR THE PROBABILITY OF EXCITATION BY ELECTRON IMPACT. F. H. Dorman, J. D. Morrison, and A. J. C. Nicholson (Commonwealth Scientific and Industrial Research Organization, Melbourne). J. Chem. Phys. 32, 378-84(1960) Feb.

The threshold law for processes of excitation is difficult to measure directly and lack of experimental evidence prevented a choice being made between different theoretical treatments. The ionization efficiency curves for the ion-pair processes, I^+ from I_2, O^+ from O_2, and C^+ from CO, and for what is herein denoted as auto-ionization in N_2^+ and O_2^+ were measured. It is shown that these curves measure excitation probabilities and that the threshold law is in all cases a step function of the energy. The implications of this with regard to the assignment of dissociation products and the measurement of appearance potentials are discussed. (auth)

9869

THRESHOLD IONIZATION OF HCl BY ELECTRON IMPACT. R. E. Fox (Westinghouse Research Labs., Pittsburgh). J. Chem. Phys. 32, 385-6(1960) Feb.

The ionization of HCl by electron impact was studied in a mass spectrometer with a pseudomonoenergetic electron beam. The ionization potential of HCl was determined as 12.56 ± 0.1 ev. The ionization curve at threshold exhibits excessive curvature which is attributed to the $^3\Pi_i$ doublet ground states of the ion estimated to be separated by 0.3 ev. A sharp change in slope of the ionization curve at 1.6 ev above threshold is attributed to the onset of ionization of the $A\ ^2\Sigma^+$ excited state of HCl^+. (auth)

9870

DYNAMICAL JAHN-TELLER THEOREM. William L. Clinton (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 32, 626-7(1960) Feb.

It is shown that the Jahn-Teller theorem, formulated on the basis of the Hellmann-Feynman theorem, can be extended to the dynamical case if the nuclei are considered as moving classically and therefore giving rise to time-dependent terms in the electronic Hamiltonian. An example is given which corresponds to D_{2h} spatial symmetry containing energy gradients with respect to the

doubly degenerate displacement coördinate $q = b_1q_1 + b_2q_2$. Nuclear displacement coördinates are treated as time-dependent perturbations on the electronic state ψ. (C.J.G.)

9871

RATIONAL APPROXIMATIONS FOR THE DEBYE FUNCTIONS. Henry C. Thacher, Jr. (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 32, 638(1960) Feb.

Rational approximations are given for the Debye functions over the range $0 \leq X \leq 10$. (C.J.G.)

9872

CaS: Cu, Eu ELECTROLUMINESCENT PHOSPHORS. A. Wachtel (Westinghouse Electric Corp., Bloomfield, N. J.). J. Electrochem. Soc. 107, 199-206(1960) Mar.

Introduction of Cu into CaS: Eu does not interfere with the red Eu^{2+} emission. Excitation of the blue CaS: Cu emission is more effective by 3650A than by 2537A. Firing with excess Cu gives rise to deposits of free Cu_2S which may cause an efficient system of contact electroluminescence. The electroluminescent properties depend on the physical characteristics of the phosphors, including its state of agglomeration. At moderate concentrations of Eu, the blue emission of CaS: Cu is entirely suppressed in electroluminescent excitation. (auth)

9873

THE ION DISTRIBUTION ABOVE THE F_2 MAXIMUM. Francis S. Johnson (Lockheed Aircraft Corp., Sunnyvale, Calif.). J. Geophys. Research 65, 577-84(1960) Feb.

Observations of the ion distribution in the ionosphere indicate that the distribution up to 550 km is controlled in part by changes in the recombination rate with altitude, although diffusion exerts an increasingly important influence above the F_2 maximum. It is further concluded that the ion distribution above 550 km is controlled by diffusion and not by recombination, although a further reduction in recombination rate with increasing altitude does occur. Charge-exchange reactions between oxygen ions and hydrogen atoms at an altitude near the base of the exosphere provide a source of thermal protons which move upward along the magnetic field lines together with an equal number of electrons and produce a medium for the propagation of radio whistlers. The computed distribution of protons and electrons is in reasonable agreement with whistler observations. The whistler medium is of telluric origin, and the source of ionization is the same as that for the F region. It is suggested that the region above 1800 km in which protons predominate over all other ions be called the protonosphere, to distinguish it from the lower ionized region normally referred to as the ionosphere. (auth)

9874

SOLID-PHASE DIFFUSION PHENOMENA ACCELERATED BY IRRADIATION. E. Germagnoli (Centro Informazioni Studi Esperienze, Milan). Met. ital. 51, 505-8(1959). (In Italian)

Experimental results on the effects of radiation on solid-phase diffusion are reviewed. Particular attention is given to the results of Damask and Dienes (J. Appl. Phys. 29, 1713(1958)) who showed how neutron flux increases the diffusion coefficient at low temperatures. This effect is attributed to the presence of an excess of point lattice defects with respect to the concentration at thermal equilibrium. (T.R.H.)

9875

SELECTED PROBLEMS IN RENORMALIZATION THEORY. G. Källén (Nordisk Institut for Teoretisk Atomfysik, Copenhagen). Nuovo cimento (10) 14, Suppl. No. 1, 105-30 (1959). (In English)

The similarity between quantum field theory and non-relativistic quantum mechanics is shown by imposing a generalization of the canonical quantization rules on the classical field operators. A discussion of the classical field theory and its quantization is presented. Equations of quantum electrodynamics are utilized in calculations of vacuum polarization by external fields. The Lee model is used to obtain a clearer insight into the treatment of current field theory and renormalization. The perturbation theory is used in the treatment of the external field and the radiation field in renormalization theory derivations. (B.O.G.)

9876

THE FRAMEWORK OF QUANTUM FIELD THEORY. R. Haag (Princeton Univ., N. J.). Nuovo cimento (10) 14, Suppl. No. 1, 131-52(1959). (In English)

A summary of lectures is presented to give an account of a particular approach to quantum field theory. This approach is being incorporated in some areas as an "approach from basic principles." The principles discussed, which lead to the systematic analysis approach, are: the basic mathematics of quantum physics; the invariance of the theory under inhomogeneous Lorentz transformations; and the fact that all the states of the system described correspond to collision processes between particles, the number of which may be arbitrarily large but never infinite. This third postulate serves to select that particular type of representation of the inhomogeneous Lorentz group which is of interest in the quantum field theory. By assuming that the basic quantities in which all previously defined notions have to be expressed are operator fields with a certain set of properties, the connection between the described S-matrix frame and the quantum field theory is established. (B.O.G.)

9877

THEORY OF COUPLED QUANTIZED FIELDS. E. R. Caianiello (Università, Naples). Nuovo cimento (10) 14, Suppl. No. 1, 177-91(1959). (In English)

A field theory is considered in which the equations of motion are known; the algebraic tools used to handle these equations are investigated. In this electrodynamic consideration two algorithms appear: the pfaffians in the fermion fields and the hafnians in the boson fields. The usefulness of these algorithms in their respective fields are explained. Appropriate mathematical tools are obtained for the boson and fermion fields from the relation between Grassmann and Clifford algebra. An explanation is presented as to how this formalism is applied to electrodynamics. The cases of the quantized boson and fermion fields are summed. (B.O.G.)

9878

COVARIANT FORMALISM OF A FIELD WITH INDEFINITE METRIC. M. Froissart (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, Suppl. No. 1, 197-204(1959). (In English)

The structure of a relativistic field which contains "ghost" (zero norm) states is investigated. Restrictions are made for the case of free fields, which can be thought of as asymptotic parts of a more complicated theory. According to the interpretation the in- or out-going fields may be eliminated from the physical results. If explicit calculations are to be made in any more concrete theory, it is easier to handle dipole ghosts than exponential ghosts. (B.O.G.)

9879

THE SHIELDING OF A FIXED CHARGE IN A HIGH-DENSITY ELECTRON GAS. J. S. Langer and S. H. Vosko

(Carnegie Inst. of Tech., Pittsburgh). Phys. and Chem. Solids 12, 196-205(1960) Jan.

The shielding of a small fixed charge in a high-density electron gas is calculated by many-body perturbation theory. This technique is used to calculate the potential energy of a classical test charge as a function of distance from the fixed charge. A closed expression for the density of displaced electrons is derived by means of Poisson's equation and evaluated numerically for several densities of the electron gas. An asymptotic form is also given. (auth)

9880

HEAT TRANSPORT IN LIQUID He^3. D. M. Lee and Henry A. Fairbank (Yale Univ., New Haven). Phys. Rev. 116, 1359-64(1959) Dec. 15.

The thermal conductivity of liquid He^3 at a pressure of $\frac{1}{3}$ atmosphere was determined experimentally and found to increase slowly from 7×10^{-5} watt/cm°K at 0.24°K to 16×10^{-5} watt/cm°K at 2.7°K with no evidence of superfluidity. Several models of liquid He^3 based on Fermi-Dirac statistics predict a 1/T dependence for the thermal conductivity of He^3 at the lowest temperatures, but no such behavior was observed down to 0.24°K. A study of the convective heat transport in the liquid has indicated that the coefficient of thermal expansion becomes negative below about 0.5°K. A thermal boundary resistance across a copper-liquid He^3 interface was found which is similar in magnitude and temperature dependence to that found for a copper-superfluid He^4 boundary. (auth)

9881

HIGH-CURRENT SUPERCONDUCTIVITY. R. H. Parmenter (RCA Labs., Princeton, N. J.). Phys. Rev. 116, 1390-9 (1959) Dec. 15.

The Bardeen, Cooper, and Schrieffer theory of superconductivity is extended to the case of high current densities by explicitly including in the phonon-induced electron-electron attraction the modification of the phonon spectrum in a moving coordinate system. This modification results from the Doppler effect. In materials having cross-sectional dimensions of the order of the penetration depth, it is shown that at current densities of the order of 10^9 amp/cm^2 the superconducting state is stable relative to the normal state, this holding both in superconducting metals and in metals ordinarily not considered superconducting at all. For this high-current state, it appears possible to obtain superconducting transition temperatures as high as room temperature. Means for achieving such an effect experimentally are discussed. (auth)

9882

OPTICAL OBSERVATION OF EXCHANGE SPLITTING IN YTTERBIUM IRON GARNET. K. A. Wickersheim and R. L. White (Hughes Research Labs., Culver City, Calif.). Phys. Rev. Letters 4, 123-5(1959) Feb. 1.

Both ytterbium iron garnet and ytterbium aluminum garnet exhibit complex absorption spectra between 8500 and 10,500A which are associated with electronic and vibronic transitions from the $^2F_{\frac{7}{2}}$ to the $^2F_{\frac{5}{2}}$ levels of the Yb^{3+} ion. A sharp, intense line near 9700A was observed under medium resolution for the spectrum of Yb^{3+} in the aluminum garnet indicating an electronic transition from the ground state to the lowest of the $J = \frac{5}{2}$ levels when observed at low temperatures. The corresponding transition in ytterbium iron garnet exhibited structure under medium resolution which results from the splitting of Kramer's doublets for Yb^{3+} ions by the exchange interaction with the ferrimagnetically aligned Fe^{3+} ions. (C.J.G.)

9883

SPIN-LATTICE RELAXATION IN YTTRIUM IRON GARNET. E. G. Spencer and R. C. LeCraw (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters 4, 130-1 (1960) Feb. 1.

Spin-lattice relaxation times were measured in yttrium iron garnet at 0 to 30°K. A spin-lattice relaxation time of $\sim 1.5 \times 10^{-6}$ sec was determined at 2.5°K. A linear temperature dependence of the reciprocal relaxation time was observed. (C.J.G.)

9884

THOMAS-FERMI-DIRAC THEORY WITH CORRELATION CORRECTION. Yasuo Tomishima (Okayama Univ., Japan). Progr. Theoret. Phys. (Kyoto) 22, 1-11(1959) July.

Using the formula of the correlation energy due to Pines, the Thomas-Fermi-Dirac model with the Fermi-Amaldi correction for free atom or ion is modified to include correlations between electrons. By the use of the present model, electron distributions for free Rb^+, Kr, and Br^- are calculated, the results are shown graphically, and the energy components of the total energy are given numerically. (auth)

9885

THE THEORY OF ELECTRON PLASMA IN SEMICONDUCTORS. V. L. Bonch-Bruevich and Sh. M. Kogan (Inst. of Radio Tech. and Electronics, USSR). Soviet Phys.—Solid State 1, 1118-21(1960) Feb.

A method which uses quantum Green's functions to solve the problem of plasma oscillations and the screening law for the field of a static point-charge is presented. The fermion Green's function is determined by averaging over the canonical ensemble. By expanding the peaks of the mass and polarization operators in a constant-ratio power series in which only the first non-vanishing terms are retained, the boson Green's function D is determined using the previous calculation of the fermion Green's function. Agreement is obtained with the results by other authors. (C.J.G.)

9886

MONTE CARLO METHOD IN STATISTICAL PHYSICS. I. Z. Fisher. Uspekhi Fiz. Nauk 69, 349-69(1959) Nov. (In Russian)

A review is given of the basic concepts and techniques of Monte Carlo methods and the available data on utilization in the theory of crystals, liquids, and dense gases. Machine calculations in statistical physics are also discussed. (R.V.J.)

9887

LUMINESCENCE OF PLASTMASS SCINTILLATORS. I. M. Rozman and S. F. Kilin. Uspekhi Fiz. Nauk 69, 459-82(1959) Nov. (In Russian)

An attempt is made to systematize available data on the various methods of preparing plast-mass scintillators, on scintillation mechanism, and on practical utilization of scintillators. 117 references. (R.V.J.)

9888

INVESTIGATION OF THE LUMINESCENCE AFTERGLOW OF TERBIUM SALT SOLUTIONS BY MEANS OF AN ELECTRONIC SHUTTER. Y. V. Kondrat'eva and V. B. Ustinov. Vestnik Leningrad. Univ., Ser. Fiz. i Khim. No. 1, 5-10(1959).

The "electronic shutter" method was used to investigate the luminescent afterglow of terbium salt solutions. The luminescent spectrum was excited by spark discharge between nickel electrodes. The luminescence duration τ was

measured at various temperatures for the bands at 5890, 5450, and 4890 A of $Tb_2(SO_4)_3$ in water and sulfuric acid and $TbCl_3$ in aqueous solution. The results are tabulated. It was shown that τ is equal for all the bands studied. The variation of τ and intensity with temperature is strongest for terbium sulfate in concentrated sulfuric acid. The greatest variation is found in the temperature range from 0 to 80°C. The variation of τ and intensity with temperature is similar. (TCO)

9889

ON THE SLOWING-DOWN OF NEUTRONS IN TWO ADJACENT MEDIA. Tsu-chia Huang. Wu Li Hsüeh Pao 14, 153-62(1958). (In Chinese)

The slowing-down densities of neutrons in two adjacent media of different properties were calculated according to the age theory. The outer medium is extended to infinity. The inner medium consists of a sphere and contains a monoenergetic fast neutron-source in the form of a concentric spherical shell. The method of Laplace transformation is used in solving the problem. For a concrete case where the media are heavy water and graphite, and the fast neutron source is of energy 2 Mev, numerical results for the slowing-down densities at thermal energy are obtained and compared with those obtained by the usual two-group approximation. (Sci. Abstr. China; Mathematical and Phys. Sci. No. 1, 1958, abstract No. 56.)

9890

PLASMA COMPOSITION, PLASMA DENSITY, ENTHALPY, AND SPECIFIC HEAT OF OXYGEN AT 1, 3, 10, AND 30 ATM. IN THE TEMPERATURE RANGE BETWEEN 1000 AND 30,000°K. F. Burhorn and R. Wienecke (Siemens-Schuckertwerke, Erlangen, Ger. and Universität, Kiel). Z. physik. Chem. (Leipzig) 213, 37-43(1960). (In German)

The thermodynamic functions of oxygen between 1000 and 30,000°K were calculated and tabulated. The methods used in the calculations are briefly explained. (J.S.R.)

9891

ON THE DIFFRACTION OF ELECTROMAGNETIC WAVES ON AN IDEALLY-CONDUCTING PLANE WITH A ROUND HOLE. G. A. Grinberg and Yu. V. Pimenov (Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Tekh. Fiz. 29, 1206-11(1959) Oct. (In Russian)

The problem of wave diffraction in an ideally conducting plane with round holes (normal gradient) was studied. Solutions of integral equations are derived with the assumption that ka is considerably larger than unity (k is the wave number, a is the radius of the hole). Numerical calculations indicate that the solutions offer sufficiently accurate results at small values of γ. (R.V.J.)

9892

INFLUENCE OF THE RAMSAUER-TOWNSEND-EFFECT ON THE MOBILITY OF ELECTRONS IN SPECTRAL PURE ARGON. A. A. Vorob'ev, B. A. Ivanov, A. P. Komar, and V. A. Korolev (Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Tekh. Fiz. 29, 1252-8(1959) Oct. (In Russian)

Measurements were made of electron mobility in pure argon. The maximum for small magnitudes of ϵ/ρ is found on the curve of drift velocity dependence on ϵ/ρ. In this case the maximum cannot be explained by the excitation of levels of molecular admixtures in argon. However, the maximum position and magnitude agree with the postulation on the influence of the Ramsauer-Townsend effect on the mobility of electrons in argon. (tr-auth)

9893

NUCLEAR TECHNOLOGY FOR ENGINEERS. R. Hobart Ellis, Jr. New York, McGraw-Hill Book Company, Inc., 1959. 291p.

The nature of the nucleus is discussed relative to elementary particles, forces, quantum states, and nuclear systematics. The disintegration and decay modes of nuclides are considered. The characteristics of alpha, beta, gamma, and x rays, their origins, and their effects on the matter they encounter are discussed. The methods and apparatus used in the detection of radiation are described. Radioactive labeling and tracer technology and uses are discussed. The principles and uses of high-level radiation sources are examined. The effects and uses of radiation and the radiation dose and its measurement are discussed. The physics of fission and chain reaction processes and the principles, types, and uses of fission reactors are considered. Techniques of plasma physics and fusion devices are described. (C.J.G.)

Astrophysics and Cosmology

9894

RADIATION DAMPING IN A GRAVITATIONAL FIELD. Bryce S. DeWitt and Robert W. Brehme (Univ. of North Carolina, Chapel Hill). Ann. Phys. (N.Y.) 9, 220-59(1960) Feb.

The validity of the principle of equivalence is examined relative to a charged mass point moving in an externally given gravitational field. The procedure is a covariant generalization of Dirac's work on the classical radiating electron. Just as Dirac's calculation was kept Lorentz invariant throughout, the present calculation is maintained generally covariant throughout. With the aid of bi-tensors, which are nonlocal generalizations of ordinary local tensors, the manifest general covariance of each step is achieved. The Green's functions for the scalar and vector wave equations in a curved manifold are obtained and applied to the derivation of the covariant Liénard-Wiechert potentials. The computation of energy-momentum balance across a world tube of infinitesimal radius surrounding the particle world-line then leads to the ponderomotive equations including radiation damping. Because of the nonlocal electromagnetic field which a charged particle carries with itself, its use as a device to distinguish locally between gravitational and inertial fields is really not allowable. An explicit occurrence of the Riemann tensor in the ponderomotive equations is found which shows that acceleration by a "true" gravitational field can produce bremsstrahlung, thereby causing a reactive force in addition to the force of inertia. The particle tries to satisfy the equivalence principle in spite of its charge. It is only prevented from doing so (i.e., from following a geodetic path) because the electromagnetic Green's function in a curved spacetime does not generally vanish inside the light cone, but gives rise to a "tail" on any initially sharp pulse of radiation. The ponderomotive equations have exactly the same form as Dirac found for the flat-space-time case except for the addition of an integral over the entire past history of the particle, representing the effect of the "tail." (auth)

9895

OPTICAL AND RADIOPHENOMENA ASSOCIATED WITH A SOLAR ACTIVITY CENTRE. C. de Jager. Nuovo cimento (10) 13, Suppl. No. 1, 284-90(1959). (In English)

The "ideal" fully developed solar activity center (faculae, sunspots, flares, surges, spon-prominences, coronal condensations, etc.) is discussed. The coronal extension of a moderately active activity center and the relationship of

coronal condensations to flares are discussed. The "ideal" fully developed radio spectrum occurring with flares is discussed. (C.J.G.)

9896

DYNAMICAL FEATURES OF THE CHROMOSPHERE. C. de Jager. Nuovo cimento (10) 13, Suppl. No. 1, 291-8 (1959). (In English)

A description of the chromosphere is given, including both mechanical and thermal properties. Theories on the dynamics of the chromosphere are contained and a discussion of the energy balance is included. (C.J.G.)

9897

SOLAR DISTURBANCES PRODUCING TYPE II RADIO BURSTS. R. G. Giovanelli (Commonwealth Scientific Industrial Research Organization, Sydney). Nuovo cimento (10) 13, Suppl. No. 1, 299-301(1959). (In English)

Solar radio bursts of type II are discussed and it is concluded that: particle streams of different origin can stimulate the emission of type II bursts; in all limb events the streams have had velocities exceeding that of the sound in the corona; and the fundamental plasma frequency escapes from much nearer the limb than expected on the basis of a spherically symmetrical corona. (C.J.G.)

9898

FLARE SURGES, PUFFS AND TYPE III BURSTS. R. G. Giovanelli (Commonwealth Scientific Industrial Research Organization, Sydney). Nuovo cimento (10) 13, Suppl. No. 1. 302-4(1959). (In English)

The physical conditions in surges (hydrogen ejection from solar activity region) and the relationship between flare and surge are discussed. A description of type III radio bursts is given. (C.J.G.)

9899

MAGNETIC FIELD IN THE SOLAR SYSTEM. T. Gold (Harvard Univ., Cambridge, Mass.). Nuovo cimento (10) 13, Suppl. No. 1, 318-23(1959). (In English)

The magnetic field near the sun and near the earth is discussed relative to the effects of the chromosphere, the corona, cosmic ray decreases and increases, and magnetic storms on the configuration. (C.J.G.)

9900

NUCLEAR REACTIONS IN STARS. IV. BUILDUP FROM CARBON. H. Reeves and E. E. Salpeter (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 116, 1505-16(1959) Dec. 15.

Reactions leading to the formation of C, O, and Ne at temperatures T of about 10^8 °K, in the core of red giant stars, were studied previously. The nuclear reactions and resulting nucleogenesis are now studied for a gas consisting of C^{12}, O^{16}, and Ne^{20} at 6×10^8 to 10×10^8 °K and densities around 10^4 g/cc. The basic reaction rates are calculated and a set of simultaneous differential equations for various abundances as a function of time is solved numerically. The C^{12} is destroyed by compound nucleus formation from C + C collisions in about 10^5 and 1 years, respectively, at 6×10^8 and 8.5×10^8 °K. The net result is the production of some additional amounts of O^{16} and Ne^{20}; appreciable amounts of Na^{23} and the three stable magnesium isotopes (mainly Mg^{24}) and decreasing amounts of Al^{27}, Si, etc. The ratio of Na^{23} to Mg^{24} produced is almost ½, appreciably larger than the "cosmic" ratio. During the carbon burning, protons and alphas are released. At temperatures below 7×10^8 °K, neutrons are produced very copiously through the sequence $C^{12}(p,\gamma)N^{13}$; $N^{13} \rightarrow C^{13}$; $C^{13}(\alpha,n)O^{16}$. If small amounts of metals in the Fe-region (up to about one metal nucleus per 1000 C^{12} nuclei) were present originally, each metal nucleus will absorb about 30 neutrons. At temperatures above 8×10^8 °K, N^{13} is photodisintegrated and the neutron production is appreciably less. (auth)

9901

DURATION OF NUCLEOSYNTHESIS. G. J. Wasserburg (California Inst. of Tech., Pasadena) and William A. Fowler and F. Hoyle (California Inst. of Tech., Pasadena and Carnegie Institution of Washington, D. C.). Phys. Rev. Letters 4, 112-14(1960) Feb. 1.

Reynolds reported that the isotopes Xe^{128}, Xe^{129}, Xe^{130}, and Xe^{131} appeared in excess over atmospheric xenon in the stony meteorite Richardton. After termination of nucleosynthesis, a time interval Δt passed during which I^{129} underwent unsupported decay and the resulting daughter product Xe^{129} was not accumulated in meteorites. Reynolds assumed that the nucleosynthetic processes during which iodine was made were instantaneous and calculated $\Delta t = 3.5 \times 10^8$ years. Calculations on the duration of nucleosynthesis were performed assuming the iodine production to occur uniformly over a period of time large compared to the mean life of I^{129}. It was concluded that Reynolds' number is the maximum time interval which could exist between the termination of nucleosynthetic processes and the formation of the Richardton meteorite. (C.J.G.)

9902

THE ROLE OF NUCLEAR PROCESSES IN THE FORMATION OF ELEMENTS. A. K. Lavrukhina (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Uspekhi Khim. 28, 1310-42(1959) Nov. (In Russian)

An analysis is made of available data in order to evaluate various aspects of the theory of the synthesis of elements in stars. The basic laws of chemical element distributions and various theories on the origin of elements are also analyzed. 162 references. (R.V.J.)

Cosmic Radiation

9903 REIC-Memo-19

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

SPACE RADIATION AS AN ENVIRONMENTAL CONSTITUENT. Raymond E. Hess and Robert F. Badertscher. Jan. 15, 1960. 51p. Project No. 2133. Contract AF33 (616)-5171.

The radiation data from US and USSR satellites and space probes are summarized in terms of particle identifications, energy spectra, flux levels, and altitude coördinates. The Van Allen belts are not rigidly bounded regions. The region between the belts is a zone of lower particle density, rather than a zone completely devoid of particles. The particle population changes across the region between the belts, with the proton component of the inner belt diminishing sharply as the outer belt is approached. It is concluded that metals will be the least sensitive to radiation and that elastomers and organic fluids will be the most susceptible to radiation damage. (W.D.M.)

9904

CHANGES IN THE LOW-RIGIDITY PRIMARY COSMIC RADIATION DURING THE LARGE FORBUSH DECREASE OF MAY 12, 1959. F. B. McDonald and W. R. Webber (Univ. of Iowa, Iowa City). J. Geophys. Research 65, 767-70(1960) Feb.

One of the largest and most striking Forbush decreases on record occurred on May 12, 1959. The Deep River, Canada, neutron intensity is plotted for the period from

April 10 to June 30 and shows clearly this large decrease and subsequent exponential recovery. Data obtained relating to the rigidity and composition of primary cosmic particles on two balloon flights during this period are given. (W.D.M.)

9905

MEASUREMENT OF RADIATION IN THE LOWER VAN ALLEN BELT. Francis E. Holly (Air Force Special Weapons Center, Kirtland AFB, N. Mex.) and Richard G. Johnson (Lockheed Missiles and Space Research Lab., Palo Alto, Calif.). J. Geophys. Research 65, 771-2(1960) Feb.

An instrument package of eight Geiger counters, shielded and collimated in various ways, was carried to 990 km and released by an Atlas ICBM. The trajectory passed into the lower Van Allen radiation belt. The instrument package is described and the variations with altitude of peak counting in each chamber and the differential spectrum of observed radiation are given. (W.D.M.)

9906

MAGNETIC STORMS AND THE VAN ALLEN RADIATION BELTS. OBSERVATIONS FROM SATELLITE 1958ε (EXPLORER IV). Pamela Rothwell and Carl E. McIlwain (State Univ. of Iowa, Iowa City). J. Geophys. Research 65, 799-806(1960) Mar.

The changes in intensity of charged particles measured with two Geiger counters carried in Explorer IV, between 270 and 2200 km above the earth's surface in August and September 1958, were analyzed. During magnetic storms marked decreases in the intensity of trapped charged particles were observed above about 1000 km, at the fringes of the outer Van Allen belt over North America and Australia; at lower altitudes, where little trapped radiation is usually observed, the Geiger counting rates increased underneath the outer zone at magnetically disturbed times. After the great magnetic storm of September 4-5, 1958, there was a significant increase in the average energy of particles trapped in the outer zone. No changes of intensity of particles in the inner Van Allen belt were detected during the period of observation except after nuclear explosions. It is suggested that the intensity decreases observed from Explorer IV in the outer radiation zone are due largely to increased scattering and absorption of trapped charged particles produced by atmospheric heating and expansion at fairly high latitudes during magnetic storms. The intensity increases observed at low altitudes beneath the outer zone are probably due to particles scattered down from the trapping region above. The average particle-energy increase in the outer Van Allen belt after a strong magnetic storm may be due either to injection of energetic particles from the sun into the trapping zone or to some acceleration process connected with the magnetic disturbance. The absence of noticeable intensity changes in the inner Van Allen belt argues in favor of a cosmic-ray albedo neutron rather than a solar origin of inner-zone protons, particularly since there was considerable solar activity during August and September 1958. (auth)

9907

DISTRIBUTION OF TRAPPED RADIATION IN THE GEOMAGNETIC FIELD. Sekiko Yoshida, George H. Ludwig, and James A. Van Allen (State Univ. of Iowa, Iowa City). J. Geophys. Research 65, 807-13(1960) Mar.

The altitude dependence (360 to 2090 km) of the intensity of geomagnetically trapped radiation as measured with Explorer I (satellite 1958α) is given for a number of geographic locations. It is found that all intensity data in the vicinity of the magnetic dip equator and over the full range of longitude and of altitude can be represented satisfactorily by a single function of the scalar magnetic field intensity B. The value of B at the lower boundary of the inner zone of trapped radiation is a monotonically increasing function of magnetic dip latitude; such data from all available geographic locations are well represented by a single curve. (auth)

9908

COSMIC-RAY-PRODUCED HELIUM IN THE KEEN MOUNTAIN AND CASAS GRANDES METEORITES. J. H. Hoffman and A. O. Nier (Univ. of Minnesota, Minneapolis). J. Geophys. Research 65, 1063-8(1960) Mar.

The He^3 and He^4 distributions were measured in the iron meteorites Keen Mountain and Casas Grandes. In the former, a small meteorite (6.75 kg), the He^3 and He^4 concentrations did not depend upon position. In the latter, a large meteorite (1550 kg), a 'depth effect' was observed, and contours of constant He^3 and He^4 content could be drawn. An attempt is made to explain the results in terms of the model earlier presented in connection with similar work on the Grant meteorite. (auth)

9909

THE ORIGIN OF COSMIC RAYS. L. Davis, Jr. (California Inst. of Tech., Pasadena). Nuovo cimento (10) 13, Suppl. No. 1, 324-9(1959). (In English)

The properties of cosmic rays are summarized. The origin of primary cosmic rays is discussed relative to the acceleration mechanism, storage, and the mechanism by which the particles are injected into the atmosphere of the earth. (C.J.G.)

Criticality Studies

9910 RFP-174

Dow Chemical Co. Rocky Flats Plant, Denver.

INTERACTION OF TWO METAL SLABS OF PLUTONIUM IN PLEXIGLAS. C. L. Schuske, A. Goodwin, Jr., G. H. Bidinger, and D. F. Smith. Dec. 28, 1959. 14p. Contract AT(29-1)-1106. OTS.

Neutron multiplication measurements were performed on two identical finite Pu-metal slab assemblies separated and reflected by Plexiglas. (auth)

9911 RFP-178

Dow Chemical Co. Rocky Flats Plant, Denver.

PLUTONIUM PLEXIGLAS ASSEMBLIES. C. L. Schuske, G. H. Bidinger, A. Goodwin, Jr., and D. F. Smith. Jan. 20, 1960. Decl. Feb. 16, 1960. 20p. Contract AT(29-1)-1106. OTS.

Neutron multiplication measurements were made on tamped and untamped cylindrical assemblies. The assemblies consisted of Pu metal sheet moderated with Plexiglas. Experiments were performed to evaluate the effects of inhomogeneity. (auth)

Elementary Particles

9912 AD-218069

New York Univ., New York. Graduate School of Arts and Sciences.

THE SCATTERING OF ELECTRONS BY FREE ELECTRONS. Final Report. A. Shadowitz, P. Nektaredes, and M. H. Shamos. Jan. 1, 1959. 82p. Contract AF18(600)-950.

The scattering of electrons by free electrons was investigated experimentally by means of two intersecting elec-

tron beams. With a 30° angle between the beams the collisions produce higher and lower energy components in the forward cone. The higher energy component was detected with an electron multiplier preceded by a velocity gate; the latter rejected background scattering as well as the lower energy component. The scattered intensity was measured between 55 and 125° in the center-of-mass system. The energy in that system was 550 ev. The results, with statistics of about 3%, do not correspond either with the Rutherford or with the Mott scattering theories. The points of the counting rate lie on a curve which corresponds to a symmetric space wave function. No explanation is offered for the result. (auth)

9913 CEA-1095

France. Commissariat à l'Énergie Atomique, Paris. ÉTUDE DU TRANSPORT DES NEUTRONS PAR LA MÉTHODE DE MODULATION. (The Study of Neutron Transport by Oscillation Method). Victor Raievski. 1959. 101p.

Thesis submitted to Univ. of Paris.

The oscillation method is of very general use for studying the behavior of thermal neutrons in media. The main experiments are described and a general theory of them is given. This theory, which is presented in the first part, is established using the two-group approximation which has proved its efficiency in the case of thermal neutron piles. The validity of the two-group approximation is recalled. This allows definition of the meaning of the parameters used in the theory and which are measured in these experiments. The experiments carried out by this method are described, especially those performed at the Centre d'Etudes Nucléaires de Saclay where the method has been extensively used. These experiments are interpreted by means of the general theory given previously. In this way, the identity of parameters measured by this method and those given by the theory is proved. This is particularly conclusive in the case of the mean life of neutrons in a pile. (auth)

9914 CEA-tr-R-774

CORRÉLATION ANGULAIRE e-ν DANS LA DÉSINTÉGRATION BÉTA D'UN NEUTRON LIBRE. (Electron-Neutrino Angular Correlation in Beta Disintegration of a Free Neutron). Yu. V. Trebukhovskii (Trebukhovsky), V. V. Vladimirskii (Vladimirsky), V. K. Grigiriev, and V. A. Ergakov. Translated into French from Zhur. Eksptl'. i Teoret. Fiz. 36, 1314-16(1959). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14765.

9915

FIELD THEORY OF UNSTABLE PARTICLES. Julian Schwinger (Harvard Univ., Cambridge, Mass.). Ann. Phys. (N.Y.) 9, 169-93(1960) Feb.

Using the example of a spinless boson field, the structure of the simplest Green's function is developed to provide a uniform theory of particles, stable and unstable. The time decay law of unstable particles is considered and it is emphasized that a full account of the relevant physical situation must be contained in its mathematical representation, leading to the conclusion that an essential failure of the exponential decay law marks the limit of applicability of the physical concept of unstable particle. (auth)

9916

ANGULAR DISTRIBUTION OF RECOILS FROM Mu-MESON CAPTURE. M. E. Rose and R. H. Good, Jr. (Oak Ridge National Lab., Tenn.). Ann. Phys. (N.Y.) 9, 211-19(1960) Feb.

It is pointed out that direct evidence bearing on the four fermion interaction in μ-capture can be obtained by measuring the angular distribution of recoils relative to the μ-polarization. The existence of an anisotropy implies parity and charge conjugation breakdown. The sign of the anisotropy coefficient yields directly the relative helicities of neutrino and mu meson at creation. The angular distribution is calculated for $0 \rightarrow J$ transitions with parity change $(-)^{J+1}$ since this description corresponds to the most practical possibilities: capture in C^{12} and O^{16}. The anisotropy coefficient is αP where $P \approx 0.15$ is the μ-polarization and $-\alpha$ varies between 0.40 and 0.80 for C (between 0.22 and 0.73 for O) depending on the presumed existence of effective pseudoscalar and conserved vector current contributions to the interaction Hamiltonian. (auth)

9917

COLLECTIVE MOTION IN MANY-PARTICLE SYSTEMS. PART 1. THE VIOLATION OF CONSERVATION LAWS. Harry J. Lipkin (Univ. of Illinois, Urbana). Ann. Phys. (N.Y.) 9, 272-91(1960) Feb.

A method for treating collective motion is proposed which allows the use of wave functions violating conservation laws which are valid for the system. The reasons for the use of such wave functions is discussed and a simple physical interpretation is given. The method is illustrated by applications to center-of-mass motion, the electron gas in the random phase approximation, nuclear rotation, and the violation of the conservation of the number of particles. (auth)

9918

QUANTUM THEORY OF INTERACTING BOSONS. Eugene P. Gross (Brandeis Univ., Waltham, Mass.). Ann. Phys. (N.Y.) 9, 292-324(1960) Feb.

Some qualitative features of the ground state of a system of interacting bosons are discussed using wave functions suggested by the semiclassical theory of boson wave fields. For the case of weak repulsions, a variational extension of Bogolyubov's work was obtained. A finite fraction of the N particles occupies the zero momentum single particle state, and the dynamic correlations are described by pair excitations. When attractive forces play a decisive role, two cases are found. In one case a finite fraction of the particles occupies a single particle state, which is now periodic in space. The dynamic correlations are described as a generalization of pair excitations which is different in character for excitation momenta of the order of the inverse of the range of the attractive forces. The single particle state and dynamic correlations are codetermined in a systematic way. The approximate ground state shows long range order which is destroyed at finite temperatures. A second case where attractions are important is the solid state of the boson system. The ground state has the property that of the order of N orthogonal single particle states are occupied, each with an average of approximately one particle. (auth)

9919

EQUATIONS FOR THE GREENIANS AND THE VACUUM FUNCTIONALS IN THE PAIR THEORY. Yu. M. Lomsadze and B. I. Maksimov (Uzhegorodskii State Univ., USSR). Bul. inst. politeh. Iasi (N.S.) 4, No. 1-2, 121-6(1958). (In Russian)

The variative method of Schwinger is applied to the pair theory of interaction of the spinor (nucleon) field with the real pseudoscalar (π^0-meson). The equations were obtained for the Greenians of nucleons and mesons and those for the vacuum functional. The solution of the last equations is given in the form of a functional (continual) integral. (auth)

9920

CONDITIONS FOR LAMINAR FLOW OF A FOCUSED ELECTRON BEAM. P. Szulkin. Bull. acad. polon. sci., Sér. sci. tech. 7, 651-4(1959). (In English)

The conditions which must be fulfilled by a set of electron trajectories to produce laminar flow in an electron beam are discussed for two cases: the inclination of all electron tracks in zero and for all electrons the initial radius is equal to the radius of equilibrium. The equation of radial motion was solved, treating time as an independent variable. (C.J.G.)

9921

DIFFERENCE OF THE FORM OF SCINTILLATION PULSES CAUSED BY γ RAYS AND NEUTRONS. Francis Cambou and Georges Ambrosino. Compt. rend. 250, 1034-6(1960) Feb. 8. (In French)

A simple method to show clearly the differences in the shape of pulses caused by γ rays and by neutrons is described. In the case of neutrons, the intensity of the slow component found is 2.4 times larger than that in the case of γ rays. (tr-auth)

9922

SCATTERING AND POLARIZATION EFFECTS OF 3.27-Mev NEUTRONS ON DEUTERONS. M. Brüllmann, H.-J. Gerber, D. Meier, and P. Scherrer (Eidgenössische Technische Hochschule, Zurich). Helv. Phys. Acta 32, 511-48 (1959). (In German)

The differential cross section and the azimuthal asymmetry of neutrons scattered by deuterons were measured for 6 angles between 53 and 161° in the center-of-mass system, using a beam of D-D neutrons with an energy of 3.27 Mev in the laboratory system and a polarization P_e of 11%. The results are given in terms of polarization $P(\varphi)$ of an unpolarized neutron beam after scattering by deuterons. Only negligible values of this polarization $P(\varphi)$ were observed. The experiment is described in detail. The scatterer itself acts as a scintillation counter consisting of deuterated benzene (C_6D_6) and detects the recoil deuterons. A plastic scintillator is used for detection of the neutrons. Coincidences and time distribution of the pulses of the two counters are observed, using a millimicrosecond time-to-pulse-height converter. (auth)

9923

DECAY MODE AND LIFETIME OF Σ^+ IN EMULSIONS AND SOME REMARKS ABOUT THE Σ^+-LIFETIME. W. Koch, M. Nikolić, M. Schneeberger, and H. Winzeler (Universitat, Bern). Helv. Phys. Acta 32, 549-58(1959). (In English)

Lifetimes of Σ^+ and Σ^- hyperons obtained from 1600 K^- interactions in emulsions are reported. In agreement with other emulsion data the lifetime of the fast Σ's, which generally arise from multi-nucleon reactions, seems to be different from the lifetime of Σ's produced in one-nucleon reactions in bubble chambers as well as in emulsions. Two possible explanations of this discrepancy are considered: (a) An attempt is made to explain the difference between the results as due to several experimental biases. The results are taken at face value and the possibility of a real physical reason is taken into account. Suggestions are made about how to decide between the two alternatives. (auth)

9924

INTERACTIONS OF ANTIPROTONS IN NUCLEAR EMULSION. J. Dyer, H. H. Heckmann, and F. M. Smith (Univ. of California, Berkeley) and Y. Eisenberg, W. Koch, M. Nikolić, M. Schneeberger, and H. Winzeler (Universität, Bern). Helv. Phys. Acta 32, 559-66(1959). (In English)

In the last years many nuclear emulsion experiments with machine-produced antiprotons have performed. The present publication is a small contribution to the increasing statistics on antiproton data in nuclear emulsion. The principal experimental results obtained in the present experiment are the following. The annihilation mean free path was found to be $1.71^{+0.9}_{-0.4}$ cm for the energy interval between 40 Mev and 200 Mev. The average number of emitted charged pions per star was 1.80 ± 0.35 for the stars in flight and 2.13 ± 0.38 for the stars at rest. Among the 30 annihilation stars analyzed one probable K meson was found. The angular distribution of the elastic scatterings down to a scattering angle of 1° is obtained. (auth)

9925

RATIO OF NUCLEON MASS AND ELECTRON MASS. R. R. Worrall. Nature 185, 602(1960) Feb. 27.

With reference to the experimental value 1840 for the ratio of nucleon and electron mass, it may be noted that the ratio of proton mass and electron mass is given by the exponential equation $m_p/m_e = \frac{1}{2} \exp(-1) \times 10^4 = 1839.39$. More generally, the rest mass of an elementary particle, relative to the rest mass of the electron, is $m/m_e = k \exp(-x)$, and since $\exp(-x)$ is a die-away factor, this formula represents the tendency of the mass of an elementary particle to decrease. For all elementary particles except the electron with minimum rest mass, and the proton with relative rest mass $m_p/m_e = k \exp(-1)$, the tendency to decrease the rest mass has been demonstrated experimentally. (auth)

9926

COVARIANT DESCRIPTION OF POLARIZATION. L. Michel (Univ. of Paris). Nuovo cimento (10) 14, Suppl. No. 1, 95-104(1959). (In English)

A description is presented of a particle of mass $\underline{m}$ and spin $\underline{j}$ with a momentum $\underline{p}$. A density matrix is used to describe a system of pure states and mixtures of polarization states. In the zero mass case only two polarization states are available and these have opposite helicities. An application of the Dirac theory was used to explicitly construct the density matrix of the pure polarization state. Any field theoretical computation of polarization effects can be made covariantly and reduces to trace computation; it is possible to describe the computation in terms of two by two density matrices. Application is made to the Bargmann-Wigner theory of particles of arbitrary spin in the polarization states. (B.O.G.)

9927

SCATTERING MATRIX AND FIELD OPERATORS. H. Lehmann (Universität, Hamburg). Nuovo cimento (10) 14, Suppl. No. 1, 153-76(1959). (In English)

A summary is presented of lectures which are concerned with the properties of the scattering matrix which describes the interactions deduced from the general principles of the quantum field theory. The interaction is formulated in terms of field operators, which are assumed to possess: (1) an asymptotic behavior in the time component of their argument vector which ensures the possibility of a particle interpretation; (2) correct transformation properties under the inhomogeneous Lorentz group; and (3) vanishing commutators (or anticommutators) for space-like separation of their arguments. It is believed that this property corresponds to causality. By obtaining explicit properties of the scattering matrix, experimental results may be correlated and partially understood and the correctness of the axioms can be tested by confronting them with empirical facts. Included is a derivation of dispersion relations for the case of strongly interacting relativistic

particles used in formulating specific interactions such that reliable quantitative calculations can be made. (B.O.G.)

9928

REPORT AND COMMENT ON F. GÜRSEY'S "GROUP STRUCTURE OF ELEMENTARY PARTICLES." W. Pauli and B. Touschek. Nuovo cimento (10) 14, Suppl. No. 1, 205-11(1959). (In English)

Comments are presented on the work of Gürsey on the "Group Structure of Elementary Particles." These concern the relationships of spin and iso-spin and the reasonableness of extrapolating iso-spin to the leptons. The possibility that the electron mass is purely electromagnetic with no contribution from other interactions was investigated. The continuous symmetry group of an assembly of Majorana fields is considered defined as follows: (1) it commutes with the proper Lorentz group; (2) it does not involve the coördinates; and (3) it is canonical, i.e., it leaves the canonical commutation relations invariant. From the one to one correspondence between the "mass conserving" groups belonging to two arbitrary operators X_1 and X_2, it is seen that this is in complete agreement with Gürsey's results. (B.O.G.)

9929

THE SCATTERING OF ELECTROMAGNETIC WAVES BY AN ELECTRON BEAM. H. Wilhelmsson (Nordic Inst. for Theoretical Atomic Physics, Copenhagen). Nuovo cimento (10) 13, Suppl. No. 1, 311-17(1959). (In English)

The small signal theory (all a-c quantities are considered small compared to corresponding static quantities) is used to discuss the problem of scattering of an obliquely incident plane electromagnetic wave by an electron beam. Coupled equations were derived which satisfy the axial components of the electric and magnetic field vectors. The equations were solved for the case of a strong axial magnetic field ($\omega_H = \infty$) and for the case of no static magnetic field ($\omega_H = 0$). (C.J.G.)

9930

GROUND-STATE ENERGY OF BOSE-EINSTEIN GAS WITH REPULSIVE INTERACTION. Katuro Sawada (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 116, 1344-58(1959) Dec. 15.

The explicit evaluation of the ground-state energy of a Bose gas interacting through a two-body repulsive potential as an expansion essentially in powers of the density of the particles and the scattering length is given. It is shown that the problem can be treated by using diagrammatical analysis up to any orders. The energy was investigated up to the fourth order in the ordinary sense of a perturbation expansion in terms of the scattering length, but including terms up to infinite order for special classes of diagrams. The energy obtained contains in general a $\Sigma_n C_n \rho^n \ln\rho$ ($n \geq 2$, half-integer and integer) dependence, and the coefficient C_2 is evaluated. A self-consistent treatment is given following this analysis and is shown to lead to the formulation of Beliaev. (auth)

9931

EXCLUSION FACTORS IN TRANSPORT THEORY. E. I. Blount (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 116, 1365-8(1959) Dec. 15.

It has recently been shown that the customary exclusion factors should be omitted from the Boltzmann equation. This raises some conceptional difficulties in relation to the Pauli principle. The resolution of these difficulties is discussed. (auth)

9932

ELECTRON SCATTERING BY NOBLE GASES IN THE LIMIT OF ZERO ENERGY. Bennett Kivel (Avco-Everett Research Lab., Everett, Mass.). Phys. Rev. 116, 1484-5 (1959) Dec. 15.

The elastic scattering at zero energy by argon depends strongly on the polarization tail, since the contribution to the scattering length by forces inside the atom cancel. Assuming this is true for all noble gases, one can approximate their zero-energy elastic cross section by $3.52 \times 10^{-16}(p/r_0)^2$ cm^2, where both p, the polarizability, and r_0, the size of the atom, are in atomic units. Using published values of the polarizability and scaling r_0 as the cube root of the atomic number from $r_0 = 8$ for argon, we find that this expression is consistent with existing experimental data. It is conjectured that the success of this approximation is a result of the Pauli exclusion principle. (auth)

9933

COMMUTATION RULES AND SPURIOUS EIGENSTATES IN SOLUBLE FIELD THEORIES. R. E. Norton and W. K. R. Watson (California Inst. of Tech., Pasadena). Phys. Rev. 116, 1597-1603(1959) Dec. 15.

A study is made of the exactly soluble field theories which are characterized by Hamiltonians quadratic in the field variables. As an example of such a theory, a model describing the electric dipole interaction of photons and a nonrelativistic, harmonically bound electron is studied explicitly. For the cases when the cutoff is sufficiently large to admit the "runaway solutions," it is necessary in order to obtain consistency and a sensible physical interpretation that the theory be reformulated by a unique modification of the equal-time commutation rules of the field operators. The problems which arise here in connection with the "runaway solutions" are closely related to the troubles of ghost states and negative transition "probabilities" which were demonstrated or suggested to exist in other theories. It is hoped, that the procedure of reformulation required here may be a guide for the eventual resolution of the ghost-state problem should it be demonstrated that such problems actually exist in the physical, relativistic field theories. (auth)

9934

MESON-NUCLEON SCATTERING AND NUCLEAR FORCES. Victor F. Weisskopf (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 116, 1615-17(1959) Dec. 15.

A simple derivation which does not make use of field theory is given of the main results of the static theory of π-meson scattering by nucleons. The derivation serves to elucidate the connection between low-energy meson scattering and the nuclear forces at large distances. (auth)

9935

LOW-TEMPERATURE NEUTRON MODERATION. Lyle B. Borst (New York Univ.). Phys. Rev. Letters 4, 131(1960) Feb. 1.

Measurements on an energy level in the microwave spectrum of water are discussed. The inelastic cross section for scattering of 0.005 ev neutrons from $HO_{\frac{1}{2}}$ at room temperature was estimated to be 8 barns. (C.J.G.)

9936

$\Delta T = \frac{1}{2}$ SELECTION RULE AND $K_{2\pi}^+$ DECAY. Myron L. Good and W. G. Holladay (Univ. of Wisconsin, Madison). Phys. Rev. Letters 4, 138-9(1960) Feb. 1.

The validity of the $\Delta T = \frac{1}{2}$ selection rule in the weak decay of $K_{2\pi}^+$ is tested. Using Fermi's method, the enhancement factor was calculated to be $\simeq 75$ and $a_{20}/\alpha = 14$. The

result indicates that $K_{2\pi}^{+}$ decays through a strict $\Delta T = \frac{1}{2}$ weak interaction, modified by electromagnetic effects, with an attendant enhancement by a strong T = 2 final state interaction. (C.J.G.)

9937

LOW-ENERGY PARAMETERS OF HYPERON-NUCLEON INTERACTION AND Λ HYPERFRAGMENTS. S. Iwao and E. C. G. Sudarshan (Univ. of Rochester, N. Y.). Phys. Rev. Letters 4, 140-1(1960) Feb. 1.

Using the "projection theorem," an attempt is made to relate the properties of a system of A-1 nucleons and a hyperon to those of a system of A-2 nucleons in terms of the two-body matrix element of the fundamental two-particle interaction together with parentage coefficients and kinematical factors. The parameters T_Λ (average hyperon kinetic energy), S_1 and S_0 (the ^3S and ^1S matrix elements of the Λ-nuclear interaction), and the binding energies of the hyperfragments with $A \leq 5$ were determined. The difference in the binding energies of hyperfragments with p-shell nucleons and ${}_\Lambda He^5$ where B_Λ (4) = 3.08 Mev is reported. (C.J.G.)

9938

THREE-PION RESONANCE OR BOUND STATE. Geoffrey F. Chew (Univ. of California, Berkeley). Phys. Rev. Letters 4, 142-3(1960) Feb. 1.

The existence of a three-pion resonance or even a bound state at roughly the same energy as the two-pion resonance in nucleon electromagnetic structure is discussed. (C.J.G.)

9939

EFFECTS OF TWO ADDITIONAL PARTICLES ON THE SYMMETRIES IN STRONG INTERACTIONS. D. B. Lichtenberg (Michigan State Univ., East Lansing). Phys. Rev. Letters 4, 143-4(1960) Feb. 1.

The existence of two particles, one being a positively charged meson with strangeness S = 2 and isotopic spin I = 0 and the other a negatively charged baryon with S = −3 and I = 0, is postulated. The effects of these particles on the symmetries in strong interactions are discussed. (C.J.G.)

9940

OPTICAL MODEL POTENTIAL FOR K^- MESONS. M. Melkanoff, D. J. Prowse, and D. H. Stork (Univ. of California, Los Angeles). Phys. Rev. Letters 4, 183-5(1960) Feb. 15.

The optical model potential for K^- mesons was calculated through an analysis of experimental results on elastic scattering at 95 to 125 Mev. The analysis was performed for R_0 equal to 1.70 and 1.20 fermis and for a values from 0.4 to 0.72 fermis, the Coulomb radius being fixed at 1.07 fermis. A best value of the real potential if a is more than 0.50 was determined to be attractive and approximately 25 Mev. (C.J.G.)

9941

EFFECT OF MASS SPLITTINGS ON THE CONSERVED VECTOR CURRENT. R. E. Behrends (Inst. for Advanced Study, Princeton, N. J.) and A. Sirlin (New York Univ.). Phys. Rev. Letters 4, 186-7(1960) Feb. 15.

The correction to the effect of multiplet mass splittings on the effective vector β-decay matrix element, valid to all orders in strong coupling, was calculated to be $\sim 10^{-6}$. The results indicate that these effects may be completely neglected in determining the ratio of the muon- and β-decay coupling constants. (C.J.G.)

9942

STRANGENESS OF THE CASCADE HYPERON, Ξ^-. D. J. Prowse (Univ. of California, Los Angeles). Phys. Rev. Letters 4, 188-90(1960) Feb. 15.

From an event interpreted as the production of a K^+ meson and a Ξ^- hyperon by a K^- meson of 750 Mev, a strangeness number of −2 was determined for the Ξ^- hyperon. (C.J.G.)

9943

PHOTO-PRODUCTION OF PION PAIRS BY POLARISED NUCLEONS. S. K. Srinivasan (Indian Inst. of Tech., Madras) and K. Venkatesan (Univ. of Madras). Proc. Indian Acad. Sci., Sec. A 50, 392-7(1959) Dec. (In English)

The problems of producing pion pairs by polarized photon beams on polarized nucleons are examined. It is found that the angular distribution of pion pairs is sensitive to the state of polarization of the incident photon beam. (auth)

9944

NUCLEON-ANTINUCLEON ANNIHILATION PRODUCTS. Steven C. Frautschi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 15-24(1959) July.

Three models for nucleon-antinucleon annihilation are considered: the Fermi statistical model, the modification by Pomeranchuk which includes strong π-π interactions, and the Koba-Takeda model of fast "core" annihilation followed by slow emission of "cloud" pions. The parameters of the models are chosen to fit the experimental pion multiplicity $\langle n_\pi \rangle = 5.36$. It is shown that the Koba-Takeda model with a small core predicts quite different values than the other models for the average K meson energy and pion multiplicity associated with $K\bar{K}$ events. Data on these quantities would distinguish between models and provide indirect information on the π-π interaction. (auth)

9945

THE Σ-Λ RELATIVE PARITY AND THE $\bar{K}$-N REACTION. Yukihisa Nogami (Univ. of Osaka Prefecture, Sakai, Japan). Progr. Theoret. Phys. (Kyoto) 22, 25-33(1959) July.

Possible resonances in pion-hyperon scattering at low energies are qualitatively examined and some noticeable differences are found between two cases in which the Σ-Λ relative parity is even and odd. Then, supposing that, in the process $\bar{K} + N \rightarrow \pi + Y$, the strong resonances of pion-hyperon scattering in the final state will dominate over the relatively weak K-meson interaction, the possibility to conjecture the relative parities of K-meson and baryons from the experiment of this process is discussed. (auth)

9946

AMBIGUITY IN THE MIXING PARAMETER FOR NUCLEON-NUCLEON SCATTERING. Masaaki Kawaguchi (Brookhaven National Lab., Upton, N. Y.). Progr. Theoret. Phys. (Kyoto) 22, 147-8(1959) July.

Additions are presented for work done by Zastavenko et al., on unitary transformation for nucleon-nucleon scattering and Minami's ambiguity for pion-nucleon scattering. Results show that there always exists a set of mixing parameters which gives the angular distribution for the scattering. The differential cross section for the triplet state is given in equation form in terms of Racah coefficients. (B.O.G.)

9947

EFFECT OF THE FINITE SIZE OF THE PROTON ON THE COULOMB ENERGY OF He^3. Takashi Ohmura (National Research Council, Ottawa). Progr. Theoret. Phys. (Kyoto) 22, 148-50(1959) July.

Electron scattering experiments established the finite size of the proton. The effect of an assumed finite charge distribution is estimated for the Coulomb energy arising

from the small inter-proton distance in the He^4 nucleus. These calculated values for He^3 are compared with values obtained for the H^3 nucleus. The precise values of the Coulomb energy are expected to be several per cent smaller than those calculated because of the simplification of this trial function. This seems to indicate that one extended proton is consistent with the experimental data without hard core. It is speculated that a slight violation of charge symmetry which guarantees the equality of nuclear forces for proton-proton and neutron-neutron systems may occur. The actual nuclear force is apparently not charge-dependent. This is possibly the cause for the differences in the observed values for H^3 and He^3. (B.O.G.)

9948

SPIN-ORBIT SPLITTING AND TENSOR FORCE. Tokuo Terasawa (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 22, 150-2(1959) July.

The second-order effect of the tensor force on spin-orbit splitting in light nuclei through the perturbation theoretic treatment was calculated, using the meson-theoretic potential of Serber. It was found that half the experimental value of the P-state doublet splitting in He^5 or N^{15} is explained through this calculation. Previous calculations have lead to splittings of the wrong sign or of too small a magnitude, while Feingold's variational calculation gave too small a magnitude with the right sign. The comparison of this calculation with Feingold's is discussed. Further results will be reported along with the effects of the tensor forces on O^{17} and Ca^{41}. (B.O.G.)

9949

NOTE ON THE LOW ENERGY ELECTRON-HYDROGEN SCATTERING. T. Ohmura (National Research Council, Ottawa) and Y. Hara and T. Yamanouchi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 22, 152-4(1959) July.

In a previous paper the low-energy electron-hydrogen scattering was discussed on the effective range approximation. An examination of the energy range of the incident electron to which this method can be applied is presented. An error is corrected in the normalization of the ground state wave function of the negative hydrogen ion. A comparison is made of the results obtained by the variational method with those predicted by the effective range theory. (B.O.G.)

9950

NOTE ON THE SPIN-ORBIT COUPLING AND THE TENSOR FORCES. S. Takagi (Osaka Univ.); W. Watari (Osaka City Univ.); and M. Yasuno (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 154-6(1959) July.

A survey is presented on spin-orbit coupling and tensor forces in the nuclear shell model. Calculations are shown for the "exchange term," where the incident nucleon is exchanged with a nucleon in the target nucleus, and compared with results from previous reports. The magnitude of the induced polarization term is investigated for the case of negative contribution to the spin-orbit coupling. It is concluded that this process gives the spin-orbit coupling which is correct in sign and reasonable in magnitude. (B.O.G.)

9951

THE DISTORTED WAVE FUNCTIONS FOR ELECTRON MOVING IN THE FIELD OF LITHIUM ATOM. Tsing-tsuan Kou, Bing-zheng Liu, and Tsuan-xai Chee. Tung Pei Jen Min Ta Hsüeh-Tzu Jan K'o Hsüeh Hsüeh Pao No. 2, 45-59(1957). (In Chinese)

The wave equation for the motion of an electron in the static field of a lithium atom is solved by a numerical method for electron energy up to 340 v. The zero, first, and second order phases of the wave functions are plotted against the k values for the incident electrons. The distortions are much greater in the field of the lithium atom than in the field of the helium atom. The first and second order phases, which were practically negligible in the field of the helium atom, are much greater in the field of the lithium atom and are comparable with the zero order phases at the higher velocities. (Sci. Abstr. China; Mathematical and Phys. Sci. No. 1, 1958, abstract No. 51.)

9952

SLOW ELECTROMAGNETIC WAVES IN SPIRAL WAVEGUIDES WITH GYROTROPIC MEDIUM. V. P. Shestopalov and L. A. Shishkin. Zhur. Tekh. Fiz. 29, 1285-8(1959) Oct. (In Russian)

In general cases dielectric and magnetic penetrability in gyrotropic media are usually tensor values and depend on the constant magnetic field in which they are found. An analysis is made of the attenuating properties of a spiral wave-guide placed in a medium with a constant magnetic field applied along the waveguide axis. The studies are confined to a spiral waveguide system placed in a cylindrical cavity in a ferrite medium. (R.V.J.)

9953

THE STUDY OF ELEMENTARY PARTICLES BY THE PHOTOGRAPHIC METHOD. An Account of the Principal Techniques and Discoveries Illustrated by an Atlas of Photomicrographs. C. F. Powell, P. H. Fowler, and D. H. Perkins. New York, Pergamon Press, 1959. 683p. $40.00.

The development of the photographic method of recording the tracks of charged particles is described. A description of the tracks of particles and the disintegrations they produce is given. The basic features of nuclear emulsions are discussed relative to physical characteristics, processing, examination of plates, photomicrography of tracks, types of emulsions, and mechanism of track formation. Methods of measuring the length and direction of tracks and track density are discussed. The measurement of scattering by various methods is described. The identification of the tracks of charged particles, electrons, μ, K and π mesons, hyperons, hypernuclei, and antiprotons is described. The determination of physical properties and interactions of the above particles by photographic studies is discussed. The disintegrations of complex nuclei due to protons of 100 to 30,000 Mev are considered. The interactions of fast mesons and antinucleons with nuclei and nuclear collisions occurring at energies greater than 50 Bev are discussed. The heavy nuclei of cosmic radiation are discussed relative to identification of tracks, ionization measurements, velocity determination, disintegrations, and the energy spectrum. (C.J.G.)

9954

INTERNATIONAL CONFERENCE ON MESONS AND RECENTLY DISCOVERED PARTICLES e 43° CONGRESSO NAZIONALE DI FISICA, PADOVA-VENEZIA, 22-28 SETTEMBRE 1957. COMUNICAZIONI. (... and the 43rd National Congress of Physics, Padua-Venice, September 22-28, 1957. Communications). 946p. (In English, French, and Italian)

The proceedings are divided into 19 sections roughly corresponding to the actual sessions of the Conference; however, the order of some of the papers was changed so as to bring related papers nearer to one another. Several papers are represented only by an abstract and several are title listed. Separate abstracts have been prepared for the

complete papers which have not previously appeared. (W.D.M.)

9955

REACTION $\pi^- + p \rightarrow \Sigma^- + K^+$ AT 1.2 AND 1.3 BEV K.E. F. Eisler, R. Plano, N. Samios, J. Steinberger, and M. Schwartz (Columbia Univ., New York) and M. Conversi, P. Franzini, I. Mannelli, V. Silvestrini, and R. Santangelo (Universitá, Pisa, Italy). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. I-3-10. (In English)

Some results are given for an experiment on $\pi^- + p \rightarrow \Sigma^- + K^+$ reactions at 1.33 and 1.45 Bev. Experimental angular distributions are shown. Cross sections of 0.21 ± 0.03 mb at 1.45 Bev/c and 0.13 ± 0.04 mb at 1.33 Bev/c were determined. (W.D.M.)

9956

PRODUCTION CROSS SECTION FOR THE REACTIONS $\pi^- + p \rightarrow \Lambda^0 + \Theta^0$, $\pi^- + p \rightarrow \Sigma^0 + \Theta^0$, AT 0.91, 1.2 AND 1.3 BEV. F. R. Eisler, R. Plano, N. Samios, M. Schwartz, and J. Steinberger (Columbia Univ., New York) and P. Bassi, V. Borelli, G. Puppi, H. Tanaka, P. Waloschek, and V. Zoboli (Universitá, Bologna) and M. Conversi, P. Franzini, I. Manelli, R. Santangelo, and V. Silvestrini (Universitá, Pisa, Italy). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. I-11-19. (In English)

Results are reported from an experiment with propane bubble chambers exposed to the 0.91, 1.2, and 1.3 Bev Brookhaven negative π^- meson beam. Cross sections and angular distributions are given for the reactions $\pi^+ + p \rightarrow \Lambda^0 + \Theta^0$ (291 events) and $\pi^- + p \rightarrow \Sigma^0 + \Theta^0$ (40 events). These events represented about one-half of all neutral strange particles observed in the chamber. (W.D.M.)

9957

PROPERTIES OF Λ^0, Θ^0 AND Σ^0 PARTICLES PRODUCED BY 1.1 BEV π^- MESONS. C. Graves and D. Glaser (Univ. of Michigan, Ann Arbor). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. I-20-32. (In English)

Results are presented of an analysis of pictures taken of a propane bubble chamber exposed to a momentum analyzed 1.1 Bev π^- meson beam from the Brookhaven Cosmotron. The total cross sections for production of $\Lambda^0-\theta^0$ particles and $\Sigma^0-\theta^0$ particles are respectively: 0.24 ± 0.04 mb and 0.14 ± 0.04 mb. The probabilities, α_Λ and α_θ, that the Λ^0 and θ^0 particles decay by their normal charged mode are $\alpha_\Lambda = 0.57 \pm 0.10$ and $\alpha_\theta = 0.46 \pm 0.10$. The angular distribution of decay products is consistent with spin ½ for the Λ^0 particle and spin zero for the θ^0 particle. The results combined with the results of similar experiments at different energies indicate parity is not conserved in Λ^0 decay. (auth)

9958

OBSERVATION OF THE REACTION $\pi^+ + p \rightarrow \Sigma^+ + K^+$. J. C. Vander Velde and J. W. Cronin (Brookhaven National Lab., Upton, N. Y.) and D. A. Glaser (Univ. of Michigan, Ann Arbor). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. I-33-51. (In English)

Nineteen examples of the reaction were identified in a propane bubble chamber. The total cross section was found to be 0.15 ± 0.05 mb. The differential production cross section is strongly peaked forward, all nineteen events occurring at Σ^+ center-of-mass angles of less than 120°. Questions concerning parity non-conservation, parity doublets, and spin are considered along with the Σ^+ decay angular distributions. The Σ^+ lifetime was found to be $\tau = (0.95^{+0.31}_{-0.25}) \times 10^{-10}$ sec. A description of the Cosmotron π^+ beam is given. (auth)

9959

PHOTOPRODUCTION OF K PARTICLES IN HYDROGEN. A. Silverman, R. R. Wilson, and W. M. Woodward (Cornell Univ., Ithaca, N. Y.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. I-62. (In English)

The 1080-Mev bremsstrahlung beam from the Cornell electron synchrotron was used to measure the differential cross section for production of K^+ mesons at 150° center-of-mass angle by 1000-Mev photons. The K particles were produced in a hydrogen target and were identified by measuring their momentum, their specific ionization, and one of their decay particles. (W.D.M.)

9960

PRODUCTION OF HYPERONS AND HEAVY MESONS IN IRON BY PROTONS AND NEGATIVE PIONS. E. Boldt, H. S. Bridge, D. O. Caldwell, Yash Pal (Massachusetts Inst. of Tech., Cambridge). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. I-74-7. (In English)

At the time of the 1957 Rochester Conference, there appeared to be disagreement on the relative effectiveness of protons and π^- mesons for producing strange particles. Cloud chamber measurements of hyperon and heavy meson production cross sections in iron for 2.6-Bev protons and 1.8-Bev negative pions are reported. These measurements show that π^- mesons produce hyperons much more copiously than do protons, but they do not indicate any significant difference in the π^- and proton cross sections for the production of charged K mesons. (auth)

9961

THE CHARACTERISTICS OF INTERACTIONS PRODUCED BY K^--MESONS. K^--STACK COLLABORATION. B. Bhowmik, D. Evans, D. Falla, F. Hassan, A. A. Kamal, K. K. Nagpaul, and D. J. Prowse (Univ. of Bristol, Eng.); M. Rene (Université Libre, Brussels); G. Alexander, R. H. W. Johnston, and C. O'Ceallaigh (Inst. of Advanced Studies, Dublin); D. Keefe (Univ. Coll., Dublin); E. H. S. Burhop, D. H. Davis, R. C. Kumar, W. B. Lasich, M. A. Shaukat, and F. R. Stannard (University Coll., London); M. Bacchella, A. Bonetti, C. Dilworth, G. Occhialini, and L. Scarsi (Universitá, Milan); and M. Grilli, L. Guerriero, L. von Lindern, M. Merlin, and A. Salandin (Universitá, Padua). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-5-44. (In English)

A stack of 100 6" × 8" × 600μ Ilford emulsion sheets was exposed to the separated K^- beam of the Bevatron. The tracks having a grain density lying within narrow limits of that expected for a K-meson of the given beam energy were found 3 mm from the emulsion edge and followed until an interaction or decay point was reached or to the end of their range, those due to K-mesons being identified by the ionization-range method. Interactions in flight and at rest are considered in detail. Interactions at rest are discussed in terms of general properties, the π-meson energy spectrum, and Σ-hyperons. (W.D.M.)

9962

THE SMALL ANGLE SCATTERING OF K^--MESONS FROM EMULSION NUCLEI. B. Bhowmik, D. Evans, D. Falla, G. N. Fowler, A. A. Kamal, and D. J. Prowse (Univ. of Bristol, Eng.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-45-50. (In English)

A total of 36 m of track length of K^- mesons having energies between 30 and 70 Mev was followed and some 160 events having a projected angle of scatter greater than 5° were found. No events were included if the range was anomalously low to avoid the inclusion of inelastic events. The differential cross section is plotted. (W.D.M.)

9963

SOME ASPECTS OF K^- INTERACTIONS. T. F. Hoang, A. Engler, M. F. Kaplon (Univ. of Rochester, N. Y.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-48-50. (In English)

Results are given from a study of about 2000 interactions of a K^- beam of initial energy of 90 Mev incident on a stripped emulsion stack of 120 4″ × 6″ × 400 μm G5 emulsions. (W.D.M.)

9964

MESON K^- INTERACTIONS AT REST. L. Bacchella, A. Berthelot, A. Bonetti, O. Goussu, F. Levy, M. Rene, D. Revel, J. Sacton, L. Scarsi, G. Tagliaferri, and G. Vanderhaeghe. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-51-3. (In French)

Results are presented from studies of K^- meson absorption in emulsions. A total of 319 K^- stars and 72 K^-_p stars were found. The data are summed up in tables. (T.R.H.)

9965

NUCLEAR ABSORPTION OF NEGATIVE K-MESONS. W. Alles, N. N. Biswas, M. Ceccarelli, and J. Crussard (Max-Planck-Institut für Physik, Gottingen, Ger.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padus-Venice, 1957, Commun. II-56-60. (In English)

About 3,300 interactions of K^- mesons in nuclear emulsion were scanned for events in which not more than two prongs were emitted. Stars with one light and one heavy prong, stars with two heavy prongs, and Σ^- capture stars were considered. (W.D.M.)

9966

ON 1600 K^--MESONS. E. Lohrmann, M. Nikolic, M. Schneeberger, P. Waloschek, and H. Winzeler (Physikalisches Institut, Universität, Bern). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-61-8. (In English)

Employing the usual "scanning along the track" method, tracks were picked up at a mean kinetic energy $T_k = 130$ Mev and followed for a total path of 112m. The differential distribution is shown. 53m was in the energy interval between 0 and 90 Mev, and 58 m in that between 90 and 150 Mev. Interactions with nuclei, elastic scattering, and decays in flight are discussed. (W.D.M.)

9967

THE Λ TO Σ RATIO. Francis M. Webb, Edwin L. Hoff, Frank H. Featherstone, Warren W. Chupp, Gerson Goldhaber, and Sulamith Goldhaber. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-69-76. (In English)

The production of hyperons by K^- interactions with the complex nuclei Ag, Br, and CON is discussed. The production ratio Λ/Σ is derived. (W.D.M.)

9968

ON THE ENERGY SPECTRUM OF THE SECONDARY PIONS FROM K^- CAPTURE STARS IN EMULSION NUCLEI. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-77-8. (In English)

The production ratio π^-/π^+ was calculated to be 1.4 for K^- interactions in nuclear emulsion. For pions which suffer scattering the energy spectrum was tentatively obtained by using the observed shapes of secondary pion spectra in π-N scattering obtained by the Bologna group for positive and negative pions of 80 and 120 Mev in nuclear emulsion. (W.D.M.)

9969

CAPTURE OF Σ^- AT REST AND CRYPTOFRAGMENTS. K^- STACK COLLABORATION. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-79-81. (In English)

Among the Σ^- stars there are 3 events showing an energy release of more than 80 Mev. A sketch of the two events exceeding 100 Mev is given. The tracks of the particles giving rise to the secondary nuclear interaction had such a length that their identification is fairly good and every alternative interpretation is practically excluded. (W.D.M.)

9970

THE PRODUCTION OF HYPERFRAGMENTS AND Li^8 FRAGMENTS FROM STARS PRODUCED BY 4.5 BEV π-MESONS. G. C. Deka (Univ. of Bristol, Eng.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-88-95. (In English)

Work on hyperfragment and unstable fragment production in nuclear emulsion by 4.5-Bev π^- mesons is reported. The hyperfragments and Li^8 fragments were found by following each grey or black prong of each star until it left the pellicle in which the star was found. In examining some 25,000 stars, 150 Li^8 hammer tracks were found, and 50 events which at first sight were interpreted as hyperfragments. (W.D.M.)

9971

EVIDENCE FOR A (Σ^+, P) COMPOUND. M. Baldo-Ceolin, W. F. Fry, W. D. B. Greening, H. Huzita, and S. Limentani. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. II-96-8. (In English)

Additional measurements were made on a previously reported event which was interpreted as the mesonic decay of a (Σ^+, P) compound. The event consisted of two stars connected by a saturated track of 23 μ. Factors suggesting the (Σ^+) interpretation are discussed. Profile measurements on the connecting track are reported. (W.D.M.)

9972

K^+–p SCATTERINGS AND K^+ CHARGE-EXCHANGES. O R. Price and D. H. Stork (Univ. of California, Los Angeles). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. III-15. (In English)

Tracks of K^+ mesons were followed from 141 ± 10 to 90 ± 12 Mev. In 58 m of track length 3 K^+–p scattering events were found. In 58 m of track length 9 charge-exchange stars and 2 disappearances were found. (W.D.M.)

9973

K^+ INTERACTIONS WITH EMULSION NUCLEI. M. Grilli, L. Guerriero, M. Merlin, and G. A. Salandin (Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. III-16-24. (In English)

A total of 220 m of K^+ tracks in the energy region from 40 to 160 Mev has been analyzed. Some results are given on elastic and inelastic scattering, on the angular cross section for inelastic events, and the total inelastic cross section. The main difficulties which can seriously affect the final interpretations of the experimental results are pointed out. (W.D.M.)

9974

REMARKS ON THE NUCLEAR INTERACTION OF POSITIVE HEAVY MESONS. N. N. Biswas, M. Ceccarelli, and N. Schmitz (Max-Planck-Institut für Physik, Gottingen, Ger.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. III-25-6. (In English)

The necessity of the assumption of the T = 0 isospin state for the interpretation of the K^+–nucleon differential cross section is examined. It is concluded that the experimental information about K^+–nucleon scattering does not require an important intervention of the T = 0 state and of waves with l larger than zero. (W.D.M.)

9975

ANGULAR CORRELATION BETWEEN PIONS AND MUONS MEASURED IN NUCLEAR EMULSIONS. C. M. G. Lattes and P. S. Freier (Univ. of Minnesota, Minneapolis). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-17-23. (In English)

In an effort to explain the conflicting results on the value of "a" ($\Delta N/\Delta\varphi = k[1 + a \cos(\varphi + \varphi_0)]$) reported for the μ–e angular correlation, the angular distribution of the π-μ decay was investigated. The emulsion stack consisted of 16 (6 cm × 8 cm × 600 μ) Ilford pellicles pressed between two Al plates and exposed inside a magnetic shield which reduced the magnetic field intensity to about 0.01 gauss. The 120 Mev π^+ mesons entered the emulsions almost perpendicular to the leading edge after being slowed down by $1^{11}/_{16}$" of Cu. (W.D.M.)

9976

EXPERIMENTS ON THE ANGULAR DISTRIBUTION OF MUONS FROM PION DECAYS IN NUCLEAR EMULSION. R. Ammar, J. I. Friedman, R. Levi-Setti, E. Silvestrini, W. Slater, and V. L. Telegdi (Univ. of Chicago). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-24-34. (In English)

In view of previously reported departure from isotropy in muon angular distributions, it was considered desirable to perform an independent measurement of the muon angular distribution obtained from π-μ decays in emulsion. Two emulsion stacks with dimensions 2" × 4" × (12 × 1000 μm) and 2" × 4" × (8 × 1000 μm) were exposed to the 120 Mev π^+ beam from the Chicago Synchrocyclotron. Sources of possible errors are discussed in an attempt to explain the observed anisotropy. (W.D.M.)

9977

ON POSSIBLE π–μ ASYMMETRIES. B. Bhowmik, D. Evans, and D. J. Prowse (Univ. of Bristol, Eng.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-35-7. (In English)

An investigation is described which was initiated to provide independent data for comparison with the results presented by Lattes at the Varenna Conference suggesting an asymmetric emission in space of the muons in π^+ decay. A stack of stripped emulsions was exposed at the Liverpool cyclotron to the magnetically separated 100 Mev π^+ beam. An asymmetry was detected which was comparable to the statistical errors, but in an opposite sense from that reported by Lattes. (W.D.M.)

9978

DISTORTION EFFECT ON ANGULAR DISTRIBUTION IN NUCLEAR EMULSIONS. A. Manfredini. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-38-41. (In English)

To establish to what extent an angular distribution could be altered by distortion, an investigation was planned and carried out. As a basis for the experiment, the angular distribution of μ mesons ejected from π mesons at rest was chosen. The anisotropy introduced by geometrical losses and distortions on the distribution of the angle of dip was considered. (W.D.M.)

9979

CHECKS ON POSSIBLE ASYMMETRIES IN THE WEAK AND STRONG INTERACTION OF THE π^+–MESONS. L. Ferretti, R. Gessaroli, L. Lendinara, A. Minguzzi-Ranzi, A. Quareni-Vignudelli, and G. Quareni. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-46-50. (In English)

The Lattes experiment on the muon angular distribution in π^+ decay was repeated. Also strong interaction processes of the π^+ meson were inspected for possible asymmetries. Except for the lowest energy interval no significant effects were found. (W.D.M.)

9980

NOTE ON THE ANGULAR DISTRIBUTIONS OF THE DECAY PARTICLES FROM TAU-MESONS. F. Bruin and M. Bruin (Universiteit, Amsterdam) and S. Natali (Universitá, Padua). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-51-2. (In English)

Measurements were performed on the decay of tau mesons in order to test whether a number of distributions satisfy isotropy requirements or show correlations. The angles between the normals to the tau meson production and decay planes and the direction of emission of the tau meson and the pions were measured. (W.D.M.)

9981

MU MESON EXPERIMENTS WITH THE CHICAGO CYCLOTRON. V. L. Telegdi (Univ. of Chicago). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-54-62. (In English)

Experiments are described which consisted of a muon coincidence telescope and an electron coincidence telescope. The outputs of the two telescopes were fed to a time-to-pulse height converter circuit, which was connected to a 100-channel pulse height analyzer. A μ–e decay distribution was readily obtained. The sample was placed in a Helmholtz coil which was energized for part of the experiments. (W.D.M.)

9982

π–μ–e ANGULAR CORRELATION IN COSMIC RAY PLATES. P. Abrahamson, Y. Eisenberg, S. Rosendorff, and G. Yekutieli (Weizmann Inst. of Science, Rehovoth, Israel). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-64-6. (In English)

The angular correlation of π–μ–e decay in emulsions was measured. The emulsions, a stack of 42 pellicles (2" × 3" × 400 μ), were exposed to cosmic radiation at an

altitude of 30 km and a latitude 41°N. A total of 656 $\pi-\mu$ decays was found and in 647 cases a positron was identified and its angle with respect to the muon emission direction was measured. (W.D.M.)

9983

PRELIMINARY RESULTS ON THE ENERGY DEPENDENCE OF THE $\pi \rightarrow \mu \rightarrow e$ ASYMMETRY. C. Castagnoli (Istituto di Fisica Nucleare, Rome and Università, Rome). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-67-78. (In English)

A series of experiments on the non-conservation of parity in $\pi-\mu-e$ decays has shown the existence of an asymmetry in the angular distribution of the μ decay electrons. An experiment was carried out to determine if such asymmetry is dependent upon the energy of the electron. An examination was made of 532 $\pi \rightarrow \mu \rightarrow e$ decays from π mesons at rest in 600μ stripped emulsions exposed to cosmic rays. The energy of the emitted electron was determined on the basis of multiple scattering measurements with conventional methods. (W.D.M.)

9984

NON-CONSERVATION OF PARITY IN $\pi-\mu-e$ DISINTEGRATIONS OBSERVED IN NUCLEAR EMULSIONS EXPOSED IN A MAGNETIC FIELD. J. Heughebaert, M. Rene, J. Sacton, and C. Vanderhaeghe (Université Libre, Brussels). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-79-82. (In French)

An expression is derived which allows calculation of the asymmetry coefficient by observation of the number of events in emulsions exposed in a magnetic field of about 20,000 gauss. It was applied to $\pi-\mu-e$ decays observed in 600-μ nuclear emulsions and confirmed. (T.R.H.)

9985

DEPENDENCE OF ANGULAR CORRELATION IN $\pi^+-\mu^+-e^+$ DECAY ON ENERGY. A. O. Weissenberg and V. A. Smirnitskii (Smirnitsky). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-83-8. (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 1741.

9986

AN ASYMMETRY IN THE ANGULAR DISTRIBUTION OF ELECTRONS IN $\mu^+ \rightarrow e$ DISINTEGRATIONS IN PHOTOGRAPHIC EMULSIONS. I. I. Gurevich, B. A. Nikolskii (Nikolsky), A. P. Mishakova, and L. V. Surkova. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-90-5. (In English)

A study was undertaken on the angular distribution of electrons in $\pi-\mu-e$ decay. An emulsion stack $7 \times 4 \times 1$ cm consisting of 23 layers of photographic emulsions was exposed to slow π mesons. Of 4055 cases of $\pi-\mu$ decay, the decay electrons were found in all but 11 cases. (W.D.M.)

9987

ANGULAR CORRELATIONS IN $\pi^+-\mu^+-e^+$ DECAYS OBSERVED IN A PROPANE BUBBLE CHAMBER. V. V. Barmin, V. P. Kanavec, B. V. Morozov, and I. I. Pershin. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-96-106. (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 11660.

9988

POLARIZATION OF COSMIC-RAY μ-MESONS. J. M. Fowler, H. A. Primakoff, and R. D. Sard (Washington Univ., St. Louis). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IV-107-8. (In English)

Immediately after the discovery of the longitudinal polarization of muons emitted in the decay in flight of cyclotron pions, the question arose as to the possible polarization of cosmic muons at sea level, which also results from the decay in flight of pions, this time of energies of the order of Bev. An experiment to detect this polarization is described. (W.D.M.)

9989

ON THE PRIMARITY OF WEAK INTERACTIONS. S. Oneda (Univ. of Manchester, Eng.) and S. Kamefuchi (Univ. of Copenhagen). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-23-4. (In English)

Weak interactions are discussed along the lines of which interactions are really elementary, and which are the secondary effects of these elementary ones. The simplest choice of the elementary interactions are taken as weak Fermi interactions, weak Yukawa interactions, and weak Boson interactions. Consideration is given to K decay, π decay, and μ^- capture by nucleons. (W.D.M.)

9990

AN INVARIANT FORMULATION OF $|\Delta \vec{I}| = \frac{1}{2}$ RULE. B. d'Espagnat and J. Prentki (European Council for Nuclear Research, Geneva) and Abdus Salam (Imperial Coll., London). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-25-7. (In English)

Some considerations on weak interactions are briefly discussed. The violation rule $|\Delta \vec{I}| = \frac{1}{2}$ is replaced by a conservation rule. (W.D.M.)

9991

ASSOCIATED PRODUCTION NEAR THRESHOLD. B. T. Feld and G. Costa (Massachusetts Inst. of Tech., Cambridge). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-28-30. (In English)

Certain aspects of the reactions $\gamma + N \rightarrow Y + K$ and $N + N \rightarrow N + Y + K$ are considered with the intention of defining the conditions under which it may be possible to determine the parity of the system (Y−K) with respect to that of the nucleon. Properties of the cross sections and angular distributions are discussed at energies sufficiently close to threshold so that it is reasonable to assume that the production is into s- and p-waves only. (W.D.M.)

9992

ANGULAR CORRELATION FOR PRODUCTION AND DECAY OF Λ^0 AND Θ^0 PARTICLES. D. Baroncini (Università, Bologna) and V. de Sabbata (Università, Parma, Italy and Istituto Nazionale di Fisica Nucleare, Bologna). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-31-4. (In English)

The process $p + \pi^+ \rightarrow \Lambda^0 + \Theta^0$ gives rise to unstable particles Λ^0 and Θ^0 which decay most frequently as $\Lambda^0 \rightarrow p + \pi^-$ and $\Theta^0 \rightarrow \pi^+ + \pi^-$. The possible combinations due to parity conservation and parity non-conservation combined with parity-doublets in production are discussed for different cases. The cases of parity conservation or non-conservation in decay are considered. (W.D.M.)

9993

THE MULTIPLE PRODUCTION OF STRANGE PARTICLES. V. S. Barashenkov (Joint Inst. for Nuclear Research, Dubna, USSR). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-35-41. (In English)

Theoretical work is reported which was conducted at the Joint Institute of Nuclear Research on the multiple production of strange particles in high-energy collisions of elementary particles. Some of the results obtained in the study are discussed. (W.D.M.)

9994

K^+-N SCATTERING AND KK $\pi\pi$ INTERACTION. Yoshio Yamaguchi (European Council for Nuclear Research, Geneva). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-42-3. (In English)

In order to explain the repulsive force between the K^+ and the nucleon, a direct coupling between the K and π fields is proposed. The consequences of this new coupling are briefly discussed. (W.D.M.)

9995

ON K-MESON SCATTERING BY NUCLEONS WITH THE TAMM-DANKOFF RELATIVISTIC METHOD. C. Ceolin and L. Taffara (Universitá, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-44-8. (In English)

It has been pointed out that the term constituting the largest part of the S-wave in pseudoscalar coupling has a repulsive potential in Born approximation, in agreement with experimental evidence. For this reason, it was decided to examine more closely the problem of K^+-N scattering and treat it with a Tamm-Dankoff method with pseudoscalar coupling. (W.D.M.)

9996

ON THE ELASTIC SCATTERING OF K-MESONS BY NUCLEONS. C. Ceolin, N. Dallaporta, and L. Taffara (Universitá, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-49-53. (In English)

While the experimental data concerning K^+ scattering from nucleons at low energies seem to be satisfactorily interpreted through a direct pseudoscalar coupling (KNY), the similar problem concerning K^- mesons appears to be in a much more confused situation. The interpretation of K^--N elastic scattering is discussed. (W.D.M.)

9997

SOME REMARKS CONCERNING THE COMPOUND MODEL OF FUNDAMENTAL PARTICLES. L. Okun. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. V-55-64. (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 9538.

9998

STUDY OF THE ANTIPROTON ANNIHILATION PROCESS WITH A SEPARATED ANTIPROTON BEAM. O. Chamberlain, G. Goldhaber, L. Jauneau, T. Kalogeropoulos, R. Silberberg, and E. Segré (Univ. of California, Berkeley). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VI-10-28. (In English)

Features of an antiproton study carried out with nuclear emulsions are discussed. Details on the separated antiproton beam, results based on the improved statistics for antiproton annihilation and interaction, and details on new phenomena observed are given. 137 antiproton events were found. (W.D.M.)

9999

NUCLEAR SCATTERING OF 140 MEV ANTIPROTONS FROM SILVER FOR A DIFFUSE POTENTIAL. A. E. Glassgold (Univ. of Minnesota, Minneapolis and Univ. of California, Berkeley). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VI-33-6. (In English)

Three preliminary calculations of the nuclear scattering of 140-Mev antiprotons from silver using a diffuse optical model potential plus an electrostatic term are described. (W.D.M.)

10000

SOME CONCLUSIONS BASED ON CHARGE-INDEPENDENCE IN NUCLEON–ANTINUCLEON INTERACTIONS. C. Chamberlain (Univ. of California, Berkeley). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VI-37-9. (In English)

The development, at the Bevatron, of antiproton beams with useful intensities, of the order of 300 $\bar{p}$ per hour, has allowed some direct experiments to be performed on the $\bar{p}-p$ interaction. Since no neutron target is available, it has not been possible to do similar direct experiments on the $\bar{p}-n$ interaction. Work is discussed which was carried out on deuterium and hydrogen, and some information is given about the $\bar{p}-n$ cross section. (W.D.M.)

10001

PROPERTIES OF K^--MESON STARS AND CHARGED Σ HYPERONS IN EMULSION. R. G. Glasser and N. Seeman (U. S. Naval Research Lab., Washington, D. C.) and G. Snow (U. S. Naval Research Lab., Washington, D. C. and Brookhaven National Lab., Upton, N. Y.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VI-47-8. (In English)

Information obtained from along-the-track scanning of 820 K^- mesons of incident energy 82 Mev is reported. 670 of these came to rest and 150 interacted or decayed in flight. Of the latter, there were five stars from which an inelastically scattered K^- meson emerged. Some characteristics of these K^- stars are listed. Twenty $\Sigma^+ \rightarrow p + \pi^0$ decays were analyzed to obtain the mass of the hyperon. (W.D.M.)

10002

POSSIBLE EVIDENCE FOR A NEUTRAL SUPER-HYPERON. M. Annis, N. F. Harmon, and R. D. Sard (Washington Univ., St. Louis). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VI-51-3. (In English)

An unusual event was observed in a multiplate chamber placed under a penetrating shower selector at mountain altitude which appeared to be a V^0-V^+ cascade. Various possible interpretations of the event are discussed briefly. (W.D.M.)

10003

DECAY SPECTRA OF THE τ–MESON. S. McKenna (Inst. for Advanced Studies, Dublin); S. Natali (Universitá, Padua); M. O'Connell (University College, Dublin); J. Tietge (Max-Planck Institut für Physik, Gottingen); and N. Varshneya (Max-Planck Institut fur Physik, Gottingen, Ber. and University Coll., Dublin). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VI-54-60. (In English)

An analysis was made of 527 $K_{\pi 3}$ decays, of which 95% were found by track scanning and 5% by area scanning, and for which particular care had been taken to avoid as much as possible the effects of bias. All the events were found to be coplanar to within 2°. Preliminary experimental results are given. (W.D.M.)

10004

EXPERIMENTAL TEST OF PARITY NON-CONSERVATION IN HYPERON DECAYS. W. H. Barkas, P. C. Giles, H. H. Heckman, F. W. Inman, and F. M. Smith (Univ. of California, [Berkeley]) and W. Alles, N. N. Biswas, M. Ceccarelli, and J. Crussard (Max-Planck-Institut für Physik, Gottingen, Ger.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VII-5-6. (In English)

It has been pointed out that if parity is not conserved in the decay of hyperons, the distribution of the angles between the direction of the hyperon spin and the momentum of the decay secondaries may be asymmetric. A polarization effect in at-rest K^- capture by a proton is discussed. 316 events are analyzed in which only a $\pi^\pm$ meson and a $\Sigma^\mp$ hyperon were emitted. (W.D.M.)

10005

ANGULAR CORRELATIONS OF $\pi^+ - \mu^+ - e^+$ DECAYS OBSERVED WITH A PROPANE BUBBLE CHAMBER. A. I. Alikhanian, V. G. Kirillov-Ugriumov, L. P. Kotenko, E. P. Kuznetzov, and Yu. S. Popov. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VII-19-24. (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13357.

10006

REMARKS ON PRESENT KNOWLEDGE OF β-DECAY INTERACTION. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VII-25-8. (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7610.

10007

ON THE ELECTRON AND π-MESON SPECTRA IN K_{e3} DECAY. L. Okun. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VII-30-3. (In English)

An investigation of K_{e3} decays ($K^\pm \rightarrow e^\pm + \nu + \pi^0$ and $K^0 \rightarrow e^\pm + \nu + \pi^\mp$) was made in order to elucidate the nature of weak interactions. Electron spectra are given. (W.D.M.)

10008

SOME ASPECTS OF $K_{\mu 3}$ DECAY. John M. Charap (Trinity Coll., Cambridge, Eng.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VII-41-8. (In English)

The $K_{\mu 3}$ meson decays according to the scheme $K \rightarrow \pi^0 + \bar{\nu} + \mu$. Certain very simple restrictive hypotheses on the nature of the decay are made, and the spectrum and polarization of the muon under these assumptions are derived. In particular the effects of non-invariance under time-reversal are considered. (W.D.M.)

10009

SPIN OF $K_{\mu 3}$ FROM THE DECAY PROCESS. M. Pusterla (Universitá, Pisa, Italy). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VII-49-51. (In English)

The process $K \rightarrow \mu + \pi + \nu$ can be described as a weak interaction among the K-field, the π-field, and the μ and ν spinor fields. It is assumed that parity is not conserved in the process, and the values of the squares of the matrix elements are calculated for both the decay with the μ polarized backwards and forwards. It is concluded that angular distribution and polarization of the muon are different in the two cases of spin zero or one. (W.D.M.)

10010

STRONG COUPLING DECAY OF K MESONS. Luis M. Garrido. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VII-52-3. (In English)

It is assumed that there exists a direct coupling between K and π mesons and that the K particle does not have a definite intrinsic parity but that it appears in two modes of different parity, spin 0, and isospin $\frac{1}{2}$. (W.D.M.)

10011

LONG-LIVED NEUTRAL V PARTICLES. M. Bardon, K. Lande, and L. M. Lederman (Columbia Univ., New York); J. Tinlot (Univ. of Rochester, N. Y.); and W. Chinowsky (Brookhaven National Lab., Upton, N. Y.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VIII-1-4. (In English)

The properties of long-lived neutral V particles were studied with a target-to-chamber distance of 72 ft (flight time $t = 10^{-7}$ sec). Of 723 pictures scanned 10 θ_2^0 decay events were found. To determine the type of coupling involved in the lepton decay of the θ_2^0, an attempt was made to calculate the angular correlation between the charged decay products in the θ_2^0 rest system. (W.D.M.)

10012

THE PROPERTIES OF Σ-HYPERONS. K^--STACK COLLABORATION. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. VIII-10-14. (In English)

The ranges of protons emitted in the decay at rest of Σ^+ hyperons in good geometry are listed. Details of 17 events in which the K^- is captured by a free proton in the emulsion are given. Mass determinations of Σ^+, Σ^-, and K^- are summarized. Decay, elastic scattering, and interactions-in-flight of Σ hyperons are discussed. (W.D.M.)

10013

HIGH ENERGY ELECTRON-NUCLEUS SCATTERING AND BREMSSTRAHLUNG. P. Budini, G. Poiani, and I. Reina (Universitá, Trieste, Italy). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IX-17-20. (In English)

The method of electron-nucleus scattering for obtaining information on the electrical structure of the nucleon is discussed. It is pointed out that comparison of elastic and inelastic electron-nucleus scattering presents some features which may render effects due to a possible breakdown of electrodynamics at short distances accessible to experimentation. (W.D.M.)

10014

AN INTERMEDIATE COUPLING CALCULATION OF NUCLEON–ANTINUCLEON FORCES. Maurice Levy (Ecole Normale Superieure, Paris). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IX-24-31. (In English)

A qualitative explanation is given for the high absorption cross section of antinucleons in hydrogen, based on an intermediate coupling treatment of two-body forces. It is indicated that the main contribution to the annihilation of antinucleons comes from processes involving the emission of a sharply defined multiplicity of pions. (auth)

10015

HYPERON–NUCLEON FORCES FROM MESON THEORY.

D. B. Lichtenberg (Univ. of Hamburg) and Marc Ross (Indiana Univ., Bloomington). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IX-32-41. (In English)

A theoretical investigation is made of the forces between hyperons and nucleons, assuming that the forces are due to the exchange of π and K mesons. It is assumed that Λ and Σ hyperons have spin $\frac{1}{2}$ and the same parity and that the K has spin zero. Then, if the strength of the pion coupling is the same for all baryons, the hyperon-nucleon forces can be given in terms of linear combinations of empirically determined nucleon-nucleon forces (neglecting baryon mass differences). In this case the pion forces alone seem to be able to account for about 80% of the potentials which are necessary to produce the observed binding in hyperfragments. This number is quite rough because of the uncertainties in the pion forces and in making predictions about the two-body forces from hyperfragment data. Furthermore, the pion forces alone may be sufficient to bind the Σ^+-proton system. Corrections to the potentials due to baryon mass differences and to the effects of K particles are also discussed. The result of a perturbation calculation of the potentials due to K exchange indicate that for the K coupling constants of the order of unity (for scalar or pseudoscalar K) the pion potentials still strongly dominate. (auth)

10016

ON THE INTERACTION OF Ξ^- HYPERONS WITH NUCLEONS AND LIGHT NUCLEI. L. B. Okun and I. Y. Pomeranchuk. Inter. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. IX-44-7. (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13360.

10017

THE INTERACTIONS OF 95 MEV π^+-MESONS WITH EMULSION NUCLEI. M. Shafi and D. J. Prowse (Univ. of Bristol, Eng.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-2-12. (In English)

A small stack of Ilford G5 emulsion sheets was exposed to the 200 Mev/c π^+ selected beam of the Liverpool cyclotron. Tracks having grain densities $\leq 1.2 \times$ min plateau and which were $\pm 5°$ to the beam direction were followed. All interactions and elastic scattering events having a projected angle $\geq 4°$ were recorded and later analyzed. A complete analysis of all interactions was attempted. Space angles for all elastic scattering events were measured. (W.D.M.)

10018

NUCLEAR INTERACTIONS OF NEGATIVE PIONS AT 4.5 BEV. G. M. Philbert (Collège de France, Paris); E. J. Burge (King's Coll., London); and B. P. Edwards, A. A. Kamal, and D. J. Prowse (Univ. of Bristol, Eng.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-13-21. (In French)

The interactions of π^- at 4.5 Bev with the complex nuclei and protons in G5 emulsions were studied. The tracks were examined for a total of 208.6 m. Considering contamination of the beam by muons this corresponds to 198.2 m. The experimental results are given without discussion. (T.R.H.)

10019

CREATION OF π-MESONS ON ZERO ISOTOPIC SPIN NUCLEI. A. G. Meshkovskii (Meshkovsky), Yu. S. Plygin, Ya. Ya. (Ia. Ia.) Shalamov, and V. A. Shebanov. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-52-9. (In English)

The energy spectra and differential cross sections for the production of π^+ and π^- mesons on deuterium and of π^- mesons on carbon were measured for a proton energy of 660 Mev and an observation angle of 45° with respect to the beam. Comparison of the data on production of charged and neutral mesons confirms the correctness for deuterium and carbon of the relation $d\sigma^+ + d\sigma^- = 2d\sigma^0$ which follows from the hypothesis of an isotopic invariance for zero isotopic spin nuclei. (auth)

10020

INELASTIC SCATTERING OF π-MESONS BY NUCLEI. B. A. Nikolskii (Nikolsky). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-60-5. (In English)

A study was made of the inelastic scattering of π mesons with an energy of 160 Mev by the nuclei of photographic emulsions. The experimental results are compared by the probability test method by using an assumption of the validity of pair meson-nucleon collisions in a nucleus. The average potential of the interaction was determined. (W.D.M.)

10021

MONTE CARLO CALCULATIONS OF SECONDARY PION PRODUCTION FROM EMULSION NUCLEI BOMBARDED BY 1.5 GEV NEGATIVE PIONS. J. E. Crew and R. D. Hill (Univ. of Illinois, Urbana). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-67-8. (In English)

The energy spectrum of the secondary pions from emulsion nuclei bombarded by 1.5-Bev pions is given for 309 charged pions. The spectrum is compared with Monte Carlo calculations made by a Los Alamos group and with calculations made on the Illiac. (W.D.M.)

10022

POLARIZATION EFFECT IN THE SCATTERING OF 225 MEV NEGATIVE PIONS BY PROTONS. J. Ashkin, J. P. Blaser, A. Burger, J. Kunze, and T. A. Romanowski (Carnegie Inst. of Tech., Pittsburgh). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-69-75. (In English)

An experiment in progress to measure the polarization of the recoil proton in the scattering of 225-Mev negative pions by protons is described. Such a polarization measurement requires looking for an azimuthal asymmetry in a further scattering of the recoil proton by a suitable target. The experimental setup is illustrated. (W.D.M.)

10023

PION–NUCLEON S WAVE SCATTERING AND STRANGE PARTICLES. G. Patergnani (Università, Padua). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-76-8. (In English)

Possible effects due to intermediate states containing strange particles on pion-nucleon S wave scattering are investigated. Strange particle diagrams are considered which do not require Budini's parity doublet hypothesis. (W.D.M.)

10024

INVESTIGATION OF THE PRODUCTION OF π^--MESONS IN n,p COLLISIONS BY MEANS OF A LIQUID HYDROGEN

BUBBLE CHAMBER. S. Ya. Nikitin, V. Z. Kolganov, A. B. Lebedev, V. T. Smoliankin, A. P. Sokolov, and L. G. Landsberg (Academy of Sciences, Moscow). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. X-79-86. (In English)

Some preliminary results are given from an investigation of the reaction $n + p \rightarrow p + p + \pi^-$ performed at the JINR synchrocyclotron in the energy region of 300 to 700 Mev. A beam of neutrons emerging from an internal target at an angle of 5° relative to the proton beam was collimated and directed into a 10 cm hydrogen bubble chamber. In 15012 pictures, 610 three-particle stars were observed which were identified as π^- production events in n–p collisions. Angular distributions and spectra of the pions are given. (W.D.M.)

10025

ASPECTS OF SELF-DIFFUSION IN ORDERED LINES. P. Camagni (Universitá, Pavia, Italy). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XII-2-3. (In Italian)

Results of measurements of self-diffusion of Cu and Zn in Cu–Zn systems are presented and discussed. The measurements were made using Zn^{65} and Cu^{65} as tracers. (T.R.H.)

10026

PRELIMINARY MEASUREMENTS OF PARAMAGNETIC RESONANCE IN SOME NEW FREE RADICALS. P. Camagni and G. Lanzi (Universitá, Padua). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XII-4-5. (In Italian)

Paramagnetic resonance measurements were made of free radicals of phenothiazine perchlorate and naphthalene diamine hydrosulfate. (T.R.H.)

10027

THE INELASTICITY OF ENERGETIC NUCLEON-NUCLEUS INTERACTIONS IN Pb AND THE NUCLEON-NUCLEON CROSS-SECTION. K. H. Barker, C. C. Butler, B. R. French, B. W. Petley, B. W. Powell, and W. W. Neale (Imperial Coll. of Science and Tech., London). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIII-1-15. (In English)

An analysis of cloud chamber photographs of nuclear interactions in lead is presented in an attempt to produce further evidence, of a rather direct kind, for the nature of the most energetic secondary particles and to find a value for the average inelasticity in N–N collisions at above 100 Bev. This value can be derived on the basis of a simple successive-collision model of the N-nucleus interaction if assumptions are made about the N-N meson production cross section and the influence of secondary π-N collisions on the observational data. An upper limit is deduced for the proportion of K mesons present among the secondary particles. (W.D.M.)

10028

MEAN FREE PATH FOR DIRECT PAIR PRODUCTION BY ELECTRONS BETWEEN 2 AND 150 GEV. R. Weill, M. Gailloud, Ph. Rosselet (Laboratoire de Recherches Nucleaires, E. P. U. L. Lausanne, Switzerland). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIII-37. (In English)

In Ilford G5 emulsions exposed at high altitude, nine electron-photon cascades of total energy greater than 20 Bev were identified. Trajectories were divided into three classes according to the energy E of the electrons: 2 to 8 Bev, 8 to 32 Bev, and 32 to 150 Bev. Relative multiple scattering was measured whenever sufficient lengths of primary tracks were available. (W.D.M.)

10029

THE EFFECT OF MULTIPLE SCATTERING ON THE IONIZATION OF ELECTRON-POSITRON PAIR. G. Yekutieli (Weitzmann Inst. of Science, Rehovot, Israel). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIII-38-41. (In English)

It was previously shown that for the first 200 μ, the distance between the electron and positron depends mainly on the opening angle. Further away from the pair's origin the relative multiple scattering of the two members of the pair is the main factor for their separation. The ionization of a very energetic pair in emulsion is calculated at a distance from the origin where the separation is due mainly to the relative multiple scattering. (W.D.M.)

10030

ANALYSIS OF THE STRUCTURE OF ATMOSPHERIC SHOWERS. L. Bertanza, M. W. Bruin, G. Rinaldi-Fornaca, and G. P. Murtas. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIII-43-6. (In Italian)

An experimental setup is described which was used to study atmospheric showers. A core selector and hodoscopic chamber were used with 4 trays of counters. Preliminary results with the apparatus confirm its suitability. (T.R.H.)

10031

AGE AND ORIGIN OF THE SOLAR SYSTEM. Mariano Pierucci. Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIII-55-62. (In Italian)

The difficulty of study of the age and origin of the universe is pointed out, and a method based on the approach hypothesis for the universe is described. The significance of the Titius-Bode law is considered. In conclusion it is stated that the method is suitable for calculation of the age of the earth and of the solar system, and that the approach hypothesis should be revived to give verification to the vortex hypothesis of Weizsacker. (T.R.H.)

10032

NOTE ON THE 2.5-MEV MICROTRON. A. Carrelli and E. Porreca (Universitá, Naples). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIV-12. (In Italian)

A 2.5-Mev electron accelerator of the microtron type and preliminary results with it are described. The field intensity is ~520 oersteds and the electromagnetic resonance frequency is ~2920 Mc/sec. The pole-face diameter is 60 cm but the working area is 44 cm. Beam intensity is good and preliminary operation is satisfactory. (T.R.H.)

10033

A NEW METHOD FOR DETERMINING THE DIRECTION OF MOTION OF PARTICLES GIVING TRACKS IN NUCLEAR EMULSIONS. A. G. Ekspong (Uppsala Univ.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVI-31-9. (In English)

It is shown that more than 50% of the number of δ–rays in a track have an original direction in the forward hemisphere. The percentage found is 61%, rather independent of the nature of the particle and its velocity. The length of a

track segment needed to establish the direction of motion with 99% confidence is about 3 cm. (auth)

10034

AUTOMATIC SCANNING OF NUCLEAR EMULSIONS. C. Castagnoli, M. Ferro-Luzzi, and C. Franzinetti (Universitá, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVI-42-7. (In English)

An automatic scanner was previously described which was capable of counting nearly flat tracks in nuclear emulsion. An improved version of the device was built and the main variations with respect to the original device are described. The optical and mechanical apparatus, the electronics, and recorder are discussed. (W.D.M.)

10035

A FAST RECYCLING HIGH PRESSURE CLOUD CHAMBER. G. R. Evans and R. A. Donald (Univ. of Edinburgh, Scotland). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVII-1-6. (In English)

The cloud chamber is 20 cm in diameter and 20 cm deep and is filled with nitrogen to a pressure of 60 atm. The expansion is controlled by allowing a rubber diaphragm to move between two perforated brass plates, the position of one of which can be varied to produce different expansion ratios. The cycle of operations with such a chamber has consisted of one fast expansion followed by one or more cleaning expansions and finally a waiting period of at least 15 min before the next fast expansion. At this pressure the maximum sensitive time which can be obtained is 2.0 seconds. (W.D.M.)

10036

STUDY OF THE RELATIVISTIC INCREASE OF THE IONISATION CURVE IN XENON AT LOW PRESSURE. A. Lagarrique, P. Musset, A. Rousset, and X. Sauteron (Ecole Polytechnique, Paris). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVII-9-10. (In English)

The method of drop counting and curvature measurements was used to measure the high-energy ionization curve in a cloud chamber. The theoretical curve was calculated following the Sternheimer theory for a mixture of Xe (84%)–He (6%)–alcohol (19%). (W.D.M.)

10037

A NEW TRANSFORMATION IN SPECIAL RELATIVITY. Rene Reulos (Université, Grenoble, France). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVIII-4-11. (In English)

A new transformation in special relativity was previously considered which is not the classical Lorentz transformation but a linear one, not only with respect to the coordinates, but also with respect to the components of the velocity. This transformation is connected to the Hamiltonian quarternions and Dirac matrices. An application to wave mechanics is presented. (W.D.M.)

10038

MASS SPECTRA OF ELEMENTARY PARTICLES. Rene Reulos (Université, Grenoble, France). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVIII-20-5. (In French)

Formulas are presented to show the relation of mass spectra to the universal constants elementary charge, Planck's constant, velocity of light, and gravitation constant. (T.R.H.)

10039

TRANSPORT OF ANGULAR MOMENTUM IN A WAVE GUIDE. G. Toraldo di Francia (Istituto Nazionale di Ottica, Florence). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XVIII-28-34. (In English)

The angular momentum carried by electromagnetic radiation in a wave guide is evaluated by means of the mechanical actions exerted by the wave. In the case where the field consists of a superposition of two or more degenerate modes, one can assume the dielectric to have a very small conductivity and then evaluate the total moment exerted by the field upon the electric currents generated in the dielectric. Angular momentum is found to travel with the same velocity as the energy. In the case of two non-degenerate modes a continuous exchange of angular momentum takes place between the field and the walls of the wave guide and vice versa. It turns out that the angular momentum travels with a velocity which is the arithmetic mean of the group velocities of both modes. (auth)

10040

MASSES OF K–PARTICLES AND HYPERONS. M. Friedlander (Washington Univ., St. Louis). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIX-3-4. (In English)

Masses and mean life estimates are summarized for K particles and hyperons. (W.D.M.)

10041

A SUMMARY OF THE PRESENT POSITION OF K^+–MESON INTERACTIONS. S. Goldhaber (Univ. of California, Berkeley). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIX-5-7. (In English)

The position on K^+ meson interactions is summarized in terms of the interactions with hydrogen, the interactions with nucleons within complex nuclei, and elastic scattering from nuclei. (W.D.M.)

10042

SUMMARY OF THE PRESENT POSITION ON THE INTERACTIONS OF K^-–MESONS. G. Goldhaber (Univ. of California, Berkeley). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIX-8-13. (In English)

The position on the interactions of K^- mesons is summarized in terms of proton interactions, decay at rest, decay in flight, elastic scattering from nuclei, and Σ to Λ ratios. (W.D.M.)

10043

ASYMMETRY IN HYPERON DECAY. B. T. Feld (Massachusetts Inst. of Tech., Cambridge). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIX-14-15. (In English)

Results from investigations on asymmetries in Λ^0 and $\Sigma^\pm$ decay are summarized. (W.D.M.)

10044

A SUMMARY OF THE PRESENT POSITION ON THE SPATIAL PROPERTIES OF THE $\pi-\mu-e$ MESON AND THE $\pi-\mu-e$ ASYMMETRY. V. L. Telegdi (Univ. of Chicago). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIX-17-20. (In English)

The use of magnetic fields in the study of $\pi-\mu-e$ asymmetries is discussed and the absolute value of the asymmetry coefficient is considered. Work on the energy dependence of the asymmetry parameter on the electron momentum is summarized. (W.D.M.)

10045
THE NATURE OF NUCLEAR INTERACTIONS AT ENERGIES $>10^{12}$ EV. Marcel Schein (Univ. of Chicago). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIX-21-4. (In English)

It is of great importance to explore the nature of nuclear interactions at energies of 10^{12} ev. The field is accessible to experimentalists by making use of accurate measurements in nuclear emulsions. Some of the fundamental questions being pursued in this field are discussed. (W.D.M.)

10046
THE PRESENT POSITION OF THEORETICAL PHYSICS IN RELATION TO THE ELEMENTARY PARTICLES. L. Rosenfeld (Univ. of Manchester, Eng.). Intern. Conf. Mesons and Recently Discovered Particles e 43° Congr. naz. fis. Padua-Venice, 1957, Commun. XIX-25-6. (In English)

The position of the theoretical interpretation of elementary particle interactions is briefly summarized. Interactions of $\pi-N$, $N-N$, $p-\bar{p}$, and $N-Y$ are discussed. (W.D.M.)

Nuclear Properties and Reactions

10047 NAA-SR-Memo-3425
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY GRAPHITE SAMPLE ANALYSIS UTILIZING THE L-77 V.O. REACTOR. R. P. Johnson. May 14, 1959. 11p. OTS.

The L-77 VO Reactor was used to determine the absorption cross section of different grades of graphite to be used in the HNPF core. There were two methods to determine the absorption cross section of the graphite samples tested: period measurements and criticality methods. Experimental data from 83 individual tests indicate than an accuracy of ±2 mb and ±0.5 mb is obtainable with the methods. (W.L.H.)

10048 UCRL-5768
California. Univ., Livermore. Lawrence Radiation Lab.
GAMMA RAYS FROM INELASTIC SCATTERING OF 14-MEV NEUTRONS ON Pb^{208}. Edward Hallett and Roger Jensen. Aug. 25, 1959. 21p. Contract W-7405-eng-48. OTS.

The cross section for the production of 2.61-Mev gamma rays from the $Pb^{208}(n,n')Pb^{208}$ reaction was measured for five different angles from 50 to 130° The angular distribution appeared to be isotropic within the precision of the experiments and led to an integrated cross section of 25.5 ± 4.6 mb. (auth)

10049 AEC-tr-3982
PROPERTIES OF RESONANCE LEVELS OF FISSIONABLE NUCLEI. I. V. Kirpichnikov and S. I. Sukhoruchkin. Translated by M. S. Moore (Phillips Petroleum Co.) from Atomnaya Energ. 7, 429(1959). 36p. JCL or LC.

The position and magnitude of resonance levels cannot be predicted theoretically, and therefore direct cross section measurements appear to be the only source of the required information. The work carried out between 1955 and 1958 on the characteristic resonances of fissionable nuclei is reviewed. On the basis of existing data, the different manners of describing the interaction of neutrons and fissionable nuclei are examined. Several improved formulations are described which apply to the measurement of parameters of resonance levels. (W.D.M.)

10050 NP-tr-361
CONTRIBUTION TO THE THEORY OF HEAVY ATOMIC NUCLEI. II. LOWERING OF THE GAMOW PEAK IN EXCITATION OF THE ATOMIC NUCLEI. (CONCLUSION). Erich Bagge. Translated by F. Hudswell (U.K.A.E.A. Atomic Energy Research Establishment) from Ann. Physik (5), 33, 389-403(1938). 22p.

The lowering of the Gamow peak in the excitation of atomic nuclei is examined. The deformation vibrations set up on excitation of a heavy atomic nucleus are shown to lead to an increase of the mean particle distance from the center and, therefore, to a decrease of the potential threshold for charged particles. This was calculated approximately by assuming that the atomic nucleus behaves as a drop of an incompressible fluid which gives rise to characteristic vibrations on impact. The mean square of the amplitude of the vibrations and, therefore, the expansion of the atomic nucleus, as a function of temperature, are obtained by a method similar to the treatment of the Planck oscillator. (auth)

10051
THE PAIR PRODUCTION CROSS SECTION FOR HIGH PHOTON ENERGIES FOR THE THOMAS-FERMI AND HARTREE ATOM. T. Tietz (Univ. of Łódź, Poland). Acta Phys. Acad. Sci. Hung. 11, 47-51(1960). (In English)

Using analytical representations of the Thomas-Fermi function $\varphi(x)$ and the Hartree functions Z_p/Z, the total cross section formula is derived for pair production in the field of an atom of atomic number Z for high photon energies. Numerical results for the total cross section for pair production can be seen which agree well with the exact numerical values of Bethe and Fraser. (auth)

10052
THE PENETRABILITY OF A THOMAS-FERMI POTENTIAL BARRIER. T. Tietź (Univ. of Lódz, Poland). Acta Phys. Acad. Sci. Hung. 11, 53-7(1960). (In English)

The effect of the surrounding electrons on the nuclear barrier penetration probability is considered. Accepting the Thomas-Fermi potential barrier for a free neutral atom and using Langer's approximation, the penetration probability was calculated that a particle will penetrate the Thomas-Fermi potential barrier. The effect of the surrounding electrons causes a decrease in the barrier height and thickness to be penetrated. The theory is applied to the evaluation of the penetration probability of alpha particles. (B.O.G.)

10053
SIMPLE NON-LOCALIZABLE SYSTEMS. G. Domokos (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 11, 81-6(1960). (In English)

Two simple non-local models are investigated: a free oscillator with non-local potential, and an oscillator with non-local kinetic and potential energies. Solutions of the classical equations of motion for a finite time interval are obtained, which do not seem to exhibit physically unreasonable features. (auth)

10054
ON THE INTERACTIONS OF NUCLEAR SPIN WITH ELECTRONS IN NEIGHBORING MOLECULES. Chun C. Lin (Univ. of Oklahoma, Norman). Ann. Phys. (N.Y.) 9, 325-31(1960) Feb.

The interactions of the nuclear spin with the orbital and spin angular momenta of electrons in neighboring molecules were examined and expressions for the coupling energy derived. The gradual transition from scalar $(I\cdot L)$ to dipolar $(I\cdot L)-3R^{-2}(I\cdot R)(L\cdot R)$ type coupling is traced as the center of the electron charge distribution is moved

away from the nucleus. The usual formula for the Fermi contact interaction is shown to be valid even if the nucleus is not at the center of the electronic charge distribution, provided $|\psi|^2$ be evaluated at the nucleus. Applications of the results to the nuclear resonance experiments are discussed. One effect is a shift of the nuclear resonance lines in case the nucleus is overlapped by the charge distribution of the neighboring paramagnetic atoms. (auth)

10055

HEALTH HAZARDS FROM FISSION PRODUCTS AND FALLOUT. I. PRODUCTS OF INSTANTANEOUS FISSION OF U^{235} WITH THERMAL NEUTRONS. Kerstin Löw and Rolf Björnerstedt (Research Inst. of National Defence, Stockholm). Arkiv Fysik 13, 85-90(1958). (In English)

The decay rates of fission products resulting from the instantaneous thermal neutron fission of 10^4 U^{235} nuclei were calculated as a function of time after fission. The decay of the total beta activity of the fission product mixture was calculated. (C.J.G.)

10056

ASYMMETRIC FISSION OF HEAVY NUCLEI. S. G. Ryzhanov (Kishinev State Univ., USSR). Bul. inst. politeh. Iasi (N.S.) 4, No. 3-4, 113-18(1958). (In Russian)

Like alpha decay, the fission of heavy nuclei is considered to be a tunnel effect initiated from the main or excited level of a compound nucleus in spontaneous and induced fission respectively. Alpha-decay is considered the most distinctly asymmetric fission. By means of a generalization of the quantum mechanical formula for alpha-decay, a formula for the probability of fission of a heavy nucleus into two fragments with given atomic and mass numbers from which asymmetric fission results was derived. The distribution of the fragment yields according to their atomic and mass numbers was obtained in the form of the Gauss-function of chance deflections. The dependence of the periods of the spontaneous fission of heavy nuclei was deduced from the parameter of the stability that corresponds with the experimental results. (auth)

10057

NUCLEAR TRANSFER REACTIONS. [PART] II. M. Demeur and A. Gribaumont (Université Libre, Brussels). Bull. classe sci., Acad. roy. Belg. 45, 533-45(1959). (In French)

Perturbation theory was applied to transfer and excitation type nuclear reactions. The cross sections were evaluated by the impact parameter method. (For Part I, see Bull. classe sci., Acad. roy. Belg. 44, 472(1958).) (auth)

10058

ABSOLUTE THERMAL NEUTRON FISSION YIELDS OF U^{233}. D. C. Santry and L. Yaffe (McGill Univ., Montreal). Can. J. Chem. 38, 421-38(1960) Mar.

The absolute fission yields of 22 nuclides formed in the thermal neutron fission of U^{233} were measured radiochemically. Disintegration rates were measured by 4π β-proportional counting techniques. The identity of each nuclide was established by chemical separations and decay characteristics as determined by 4π β-counting and γ-ray scintillation spectrometry. The reaction $Co^{59}(n,\gamma)Co^{60}$ was used as a neutron flux monitor. Yields were calculated on the basis of $\sigma_f^{U^{233}}/\sigma_c^{Co^{59}} = 524/36.3$. (auth)

10059

THE YIELD OF Ba^{140} IN THE THERMAL NEUTRON FISSION OF U^{235}. D. C. Santry and L. Yaffe (McGill Univ., Montreal). Can. J. Chem. 38, 464-6(1960) Mar.

The fission product Ba^{140} is often used as a standard in fission yield determinations. A method is presented for this determination from the thermal neutron fission of U^{235}. The fission yield of Ba^{140} was found by this method to be $6.36 \pm 0.12\%$, which agrees well with previously attained values. (B.O.G.)

10060

THE EXCITATION CURVES OF THE REACTIONS $F^{19}(p,\alpha)O^{16}$ AND $Ca^{40}(p,p')Ca^{40}$ IN γ RAYS AND IN INTERNAL CONVERSION PAIRS. Serge Gorodetzky, Gilbert Sutter, Pierre Chevallier, Fernand Scheibling, and Raymond Armbruster. Compt. rend. 250, 1028-30(1960) Feb. 8. (In French)

A study was made of the yield in monopolar pairs and in pairs of different orders of multipolarity from the reactions $Ca^{40}(p,p')Ca^{40}$ and $F^{19}(p,\alpha)O^{16}$. To determine the yield, the excitation curves of these two reactions were measured in γ radiation in internal conversion pairs emitted at $\Theta = 25$ and 65°. The curves obtained for the Ca^{40} reaction with protons of 4.8 Mev are given. The number of pairs emitted was too small to consider showing radiative corrections. The curves obtained for the F^{19} reaction with 1-Mev protons are shown. The relative proportions of γ rays emitted for proton energies of 842 and 1830 kev are determined. The relative proportion of monopolar pairs was evaluated at 94% and of pairs from the 6.13-Mev level at 6%. (J.S.R.)

10061

RESONANCE ABSORPTION OF γ RADIATION OF HOLMIUM-166 AND OSMIUM-193 WITHOUT NUCLEAR RECOIL. André Bussière de Nercy, Michel Langevin, and Maurice Spighel. Compt. rend. 250, 1031-3(1960) Feb. 8. (In French)

The phenomenon of absorption and emission of γ radiation without nuclear recoil was shown for the 80-kev γ radiation of Ho^{166} and the 73-kev radiation of Os^{193}. The measurements made on Os^{193}, Os^{191}, Ta^{182}, Ho^{166}, and Sm^{153} show a disagreement with the theory which appears to be connected with the period of the excited level. (tr-auth)

10062

TRANSMISSION MEASUREMENTS WITH COLD NEUTRONS IN HYDROGENOUS LIQUIDS. R. Nasuhoglu and G. R. Ringo (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 32, 476-80(1960) Feb.

Measurements were made of the transmission cross sections of several series of organic liquids for neutrons in the wavelength region of 5 to 20 A. These cross sections should show effects from weak bonds, since the scattering cross section of hydrogen is quite sensitive to the binding of hydrogen. Results of the measurements and a description of the helical velocity selector used in making them are given. The results give evidence that the motions of the hydrogens of the methyl group are relatively free in liquids. (auth)

10063

HALF-LIFE AND DECAY OF NIOBIUM-94. R. P. Schuman and P. Goris (Phillips Petroleum Co., Idaho Falls, Idaho). J. Inorg. & Nuclear Chem. 12, 1-5(1959) Dec.

The specific activity of Nb^{94} was determined by counting and mass-analysing two samples of reactor-irradiated niobium. The β-half-life of Nb^{94} is $(2.03 \pm 0.16) \times 10^4$ years. Nb^{94} emits 703 ± 5 kev and 874 ± 5 kev γ rays with 100 per cent abundance; the 1580 kev crossover γ ray has an abundance of $<0.05\%$. The K electron capture branching of Nb^{94} is $<6\%$ of the β decay. The γ spectrum of 6.6 min Nb^{94m} was studied. (auth)

10064

HALF-LIVES OF ^{204}Tl, RaD AND ^{207}Bi. G. Harbottle

(Brookhaven National Lab., Upton, N. Y.). J. Inorg. & Nuclear Chem. 12, 6-7(1959) Dec.

Counting and balanced ion chamber measurements have given half-lives as follows: Tl^{204}, 3.91 ± 0.07 years; RaD, 20.4 ± 0.3 years; and Bi^{207}, 30.2 ± 0.5 years. (auth)

10065

ELECTRON-CAPTURE/NEGATRON-EMISSION BRANCHING RATIO OF Np^{236}(22Hr). J. E. Gindler and R. K. Sjoblom (Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 12, 8-11(1959) Dec.

A value of 1.05 ± 0.17 was determined for the electron-capture/negatron-emission branching ratio of 22 hr Np^{236} using a combination of α-counting techniques and mass spectrometric measurements. The relative production of 22 hr Np^{236} to that of long-lived Np^{236} was recalculated and found to be about seven for the interaction of 18 Mev deuterons with U^{235}. (auth)

10066

SCATTERING OF THERMAL NEUTRONS IN ALUMINIUM. L. S. Kothari (Atomic Energy Establishment, Trombay, India). Phil. Mag. (8) 4, 1325-38(1959) Dec.

In order to investigate theoretically the scattering of thermal and cold neutrons by crystals, one normally uses the Debye spectrum for the lattice vibrations and assumes the velocity of sound in the medium to be constant. Taking a more realistic model (suggested by the Born von Karman theory) for the dispersion relation and the frequency distribution function, here is calculated the inelastic scattering cross section for cold neutrons and, in the particular case of aluminum, that the results conform better with experiment. The scattering surface for long wavelength neutrons was obtained and it agrees well with the highly detailed calculations of Squires (1956). (auth)

10067

RADIATIVE PROTON CAPTURE BY O^{18}. J. W. Butler and H. D. Holmgren (U. S. Naval Research Lab., Washington, D. C.). Phys. Rev. 116, 1485-9(1959) Dec. 15.

A search for gamma-emitting levels in F^{19} between 8.3 and 9.8 Mev of excitation energy was made by bombarding a NiO target (39% O^{18}) with protons over the energy range 360 to 1960 kev. Resonances in the gamma-ray yield were observed with the use of a 3-in. diam × 3-in. sodium iodide crystal and a 20-channel pulse-height analyzer. The results are tabulated. The angular distribution of the 6.27-Mev gamma ray from the 1169-kev resonance was measured, and the results are listed in tabular form. The results of the present experiment are compared with other experiments using the $O^{18}(p,\gamma)F^{19}$, $O^{18}(p,\alpha)N^{15}$, and the $O^{18}(d,n)F^{19}$ reactions. (auth)

10068

REACTION $C^{12}(d,n)N^{13}$. A. Elwyn, J. V. Kane, S. Ofer, and D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 1490-8(1959) Dec. 15.

The reaction $C^{12}(d,n)N^{13}$ has Q = −0.28 Mev and so is expected to show strong direct interaction effects even at low energies of the bombarding deuterons. An extensive study was made of this reaction at 14 values of the deuteron energy between E_d = 1.45 Mev and E_d = 2.95 Mev. At each deuteron energy the differential cross section was measured at about 20 angles between 0 and 165°. Neutron time-of-flight techniques were used and each point on each angular distribution represents the detection of at least 10^3 neutrons. Direct interaction effects are seen at all bombarding energies in the backward as well as in the forward hemisphere. The differential cross section at 0° shows very pronounced "resonance" structure but this largely disappears in the integrated cross section and is due chiefly to interference between the direct interaction term and the probably quite small compound nucleus contribution. A rough method for eliminating the interference terms between the two mechanisms in the differential cross section is proposed and applied. The resultant "purified" angular distribution is remarkably close, in the forward hemisphere, to that predicted by simple stripping theory. A backward maximum, much lower than the forward peak, is also present but not accounted for. (auth)

10069

DIRECTIONAL AND POLARIZATION CORRELATION MEASUREMENTS ON Eu^{152m} G. T. Wood (Univ. of Copenhagen). Phys. Rev. 116, 1499-1504(1959) Dec. 15.

The spins and parities of the 1511-kev level in Sm^{152} and the 1315-kev level in Gd^{152} are discussed on the basis of directional correlation and polarization-direction correlation measurements on the 1389-122 kev and 970-344 kev gamma-gamma cascades, following the decay of 9-hour Eu^{152m}. Both levels were assigned spin and parity 1^-. In order to check the apparatus on cascades known on the basis of previous measurements, directional and polarization-direction correlation measurements were made on the 842-122 kev (from 9-hour Eu^{152m}) and 1409-122 kev (from 12-year Eu^{152}) cascades in Sm^{152}. (auth)

10070

TOTAL NEUTRON CROSS SECTION OF XENON AND KRYPTON. D. P. Mann and W. W. Watson (Yale Univ., New Haven) and R. E. Chrien, R. L. Zimmerman, and R. B. Schwartz (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 1516-20(1959) Dec. 15.

By the thermal diffusion method, using 12 meters of hot-wire columns, concentrations of the xenon isotopes in good quantity (about 57% Xe^{129} in the light fraction and 27% Xe^{136} in the heavy one) were produced without recycling. A fair-sized sample of "light" krypton, analyzing better than 50% Kr^{80}, was available from earlier thermal diffusion separation with recycling by Blais and Watson. These samples together with the normal gases were concentrated to thicknesses of about 3.3 g/cm^2 in special gas target holders for use with the Brookhaven fast chopper. For krypton, neutron widths and isotopic identifications were determined for the following levels: 27.9 ev in Kr^{83}, 39.8 ev in Kr^{82}, 106 ev in Kr^{80}, 233 ev in Kr^{83}, 519 ev in Kr^{84}, 580 ev in Kr^{84}, and 640 ev in either Kr^{78} or Kr^{86}. Total widths and radiation widths were obtained for the 27.9- and 106-ev levels by thick-thin area analysis. For xenon, new resonances are observed at 5.2 ev in Xe^{124}, 9.5 ev in Xe^{129}, 14.1, 46.0, and 76.0 ev all in Xe^{131}, 92.0 ev in Xe^{129}, and 126 ev to be assigned to either the 128, 129, or 130 isotope. (auth)

10071

NEUTRONS FROM THE PROTON BOMBARDMENT OF Li^6 AND Li^7. F. Ajzenberg-Selove and C. F. Osgood (Haverford Coll., Penna.) and C. P. Baker (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 1521-5 (1959) Dec. 15.

The $Li^7(p,n)Be^7$ and $Li^6(p,n)Be^6$ reactions were studied at E_p = 10.5 Mev, by the method of proton recoils in nuclear emulsions. The $Li^7(p,n)Be^7$ spectra at 30° and 90° show the known states of Be^7 at 0, 0.43, and 4.53 Mev. The cross section for formation of the ground state at 90° (lab) is 3.2 mb/sterad (±30%). The $Li^6(p,n)Be^6$ spectra at 30°, 60°, 90°, and 135° show ground-state groups with Q = −5.05 ± 0.2 Mev. This leads to (M − A) for Be^6 = 20.13 ± 0.2 Mev. $Be^6(0)$ is thus unbound with respect to (He^4 + 2p) by 1.35 Mev. The cross section for formation

of $Be^6(0)$ at 90° (lab) is 0.5 mb/sterad (±30%). At 90°, there is also indication of a sharp excited state at E_x = 1.5 ± 0.2 Mev. The lifetimes of $Be^6(0)$ and $Be^6(1.5$ Mev) are $\geq 4 \times 10^{-21}$ sec and $> 7 \times 10^{-21}$ sec, respectively. These results are discussed in terms of the other available information on the A = 6 isobars. (auth)

10072

COULOMB EXCITATION OF NUCLEI BY Li^6 BY Li^7 PROJECTILES. C. S. Littlejohn and G. C. Morrison (Univ. of Chicago). Phys. Rev. 116, 1526-34(1959) Dec. 15.

In order to examine the characteristics of lithium-ion-induced Coulomb excitation, and to extend the cross-section ratio technique for the determination of the multipolarity of transitions, a study was made of the γ rays emitted following electric excitation of several different target nuclei by Li^6 and Li^7 ions in the energy range 1.1 to 2.2 Mev. Measurements were made of thick-target yields of the 110-kev (E1) and 198-kev (E2) γ rays from F^{19}, the 128-kev (E2) γ ray from Mn^{55}, and the 160-kev (E2) γ ray from Ti^{47} and compared with yields calculated from the theoretical cross sections. The yields of the γ rays studied were observed to increase with beam energy in the manner predicted by theory for electric dipole or electric quadrupole excitation. The ratios of the Li^6 and Li^7 induced yields at corresponding (equal ξ) energies for E1 and E2 transitions after correction for range effects were found to agree, within the estimated errors, with the theoretical predictions for cross-section ratios. (auth)

10073

LOW-LYING ENERGY LEVELS IN Sc^{41}. H. S. Plendl and F. E. Steigert (Yale Univ., New Haven). Phys. Rev. 116, 1534-8(1959) Dec. 15.

The reaction $Ca^{40}(d,n)Sc^{41}$ was studied at 4.15-Mev bombarding energy using nuclear emulsions as detectors. Four groups of neutrons were observed with Q values of −0.57, −2.43, −2.64, and −2.85 Mev. The observed angular distributions can be fitted with distribution curves obtained from stripping analysis on the basis of r_0 = 6.0 fermi and l_p = 3, 1, 1, 1, respectively. Two additional groups of questionable assignment were observed at Q = −1.13 and −1.41 Mev. Neutron groups from reactions on C^{12} and O^{16} were also observed and served to confirm the beam calibration as well as background and other correction methods. (auth)

10074

RESONANCE FISSION WIDTHS OF U^{235} FOR LEVELS FROM 6 ev TO 50 ev. W. W. Havens, Jr., E. Melkonian, L. J. Rainwater, and J. L. Rosen (Columbia Univ., New York). Phys. Rev. 116, 1538-43(1959) Dec. 15.

The energy variation of the total and fission cross sections of U^{235} was measured with the Nevis synchrocyclotron neutron velocity spectrometer. Fission widths for most of the levels up to 50 ev were deduced from these measurements. The distribution of the 38 known fission widths shows that the number of channels available for the fission process is between one and four and is most probably two. If $\overline{\Gamma}_f$ is different for the two possible spin states of the compound nucleus, these cannot differ by more than an order of magnitude. (auth)

10075

DETERMINATION OF THE LOW-ENERGY REGION OF THE TRITIUM BETA SPECTRUM. D. C. Conway and W. H. Johnston (Purdue Univ., Lafayette, Ind.). Phys. Rev. 116, 1544-7(1959) Dec. 15.

The tritium beta spectrum was determined in a proportional counter spectrometer fitted with field-adjusting electrodes down to an energy of 200 ev. Below 1.2 kev the experimental spectra exhibit positive deviation from the theoretical spectrum which was corrected for the screening effect and for counter resolution. Various possible explanations for the deviation, which amounts to +6.5% at 0.3 kev, are examined. A possible explanation is that w, the energy to produce an ion pair in the counting gas, increases by several percent in the energy interval 1.2 to 0.25 kev. (auth)

10076

CHARGE SPECTROMETRY FOR Kr^{79}–Br^{79}. Arthur H. Snell, F. Pleasonton, and John L. Need (Oak Ridge National Lab., Tenn.). Phys. Rev. 116, 1548-51(1959) Dec. 15.

The distribution in charge of the Br^{79} atoms formed in the complex electron capture and β^+ decay of radioactive Kr^{79} was found to consist of two components; one to be mostly associated with the β^+ transitions, and the other with the electron capture transitions. Because of a difference in instrumental efficiency, the relative intensity of the two components is undetermined in the present work, but if the value of 9.3 is assumed for the total electron-capture/B^+ ratio, then the spectrum for the successive charges −1, 0, +1...+13 is as follows (figures in percent): 7.7, 3.7 (estimated), 4.0, 4.7, 12.7, 16.0, 14.3, 13.6, 11.3, 7.7, 3.3, 0.68, 0.13, 0.054, and 0.014, respectively. (auth)

10077

NEUTRON YIELDS FROM TARGETS BOMBARDED BY ELECTRONS. W. C. Barber and W. D. George (Stanford Univ., Calif.). Phys. Rev. 116, 1551-9(1959) Dec. 15.

The total neutron yields from thick targets bombarded by electrons were measured as a function of electron energy for the range 10 to 36 Mev. Targets ranging in thickness from one to six radiation lengths of C, Al, Cu, Ta, Pb, and U were used. The yields for 1- and 6-radiation-length targets of Pb at 34 Mev are 2.1×10^{-3} and 9.0×10^{-3} neutrons/electron. Extrapolation to infinite target thickness gives a value of 9.5×10^{-3} neutron/electron. The yield, comparing targets of one radiation length, from C is about 10 times smaller and that from U two times greater than the yield from Pb. An explanation of the relative Z-dependence of the yield in terms of known photonuclear cross sections is successful to within a factor of 1.5. The absolute accuracy of the results is estimated to be ±15%. Calibration of the neutron-detecting equipment was made with a RaBe source and checked by measuring the yields, due to electro- and photodisintegration of the deuteron, from a heavy-water target. In addition, yields from thin targets of Be and Cu were observed as a function of electron energy. The data for Be yield a value of (0.018 ± 0.003) Mev-barn for the (γ,n) cross section integrated to 17 Mev. The data for Cu were analyzed and combined with other measurements to give an approximate cross section for the $Cu(\gamma,pn)$ reaction. (auth)

10078

ANGULAR DISTRIBUTION OF Li^8 FROM $Be^9(Li^7,Li^8)Be^8$. E. Norbeck, J. M. Blair, L. Pinsonneault, and R. J. Gerbracht (Univ. of Minnesota, Minneapolis). Phys. Rev. 116, 1560-2(1959) Dec. 15.

Angular distribution curves and an excitation curve are given for Li^8 produced by the reaction $Be^9(Li^7,Li^8)Be^9$ with Li^7 beam energies between 2.0 and 4.0 Mev. The angular distribution may be roughly approximated by $\sin^2\theta$ in the center-of-mass system, with the central peak shifting forward as the energy is increased. The total cross section for the production of Li^8 increases with energy with no indication of resonances. (auth)

10079

LEVELS OF P^{29} FROM $Si^{28}(p,p)Si^{28}$ AND $Si^{28}(p,p')Si^{28}$. J. Vorona, J. W. Olness, W. Haeberli, and H. W. Lewis (Duke Univ., Durham, N. C.). Phys. Rev. 116, 1563-71 (1959) Dec. 15.

Differential cross sections for the elastic and inelastic scattering of protons from Si^{28} were measured at center-of-mass scattering angles of 167.7°, 141.3°, 90.0°, and 54.7° for proton energies between 1.4 and 3.8 Mev. Resonances were observed at proton energies of 1.66, 2.09, and 2.88 Mev, in addition to the resonances at 3.10, 3.34, 3.58, and 3.71 Mev which correspond to levels in P^{29} reported previously by other investigators from studies of the γ rays from $Si^{28}(p,p'\gamma)Si^{28}$. Differential cross sections and angular distributions for inelastic scattering to the 1.78-Mev first excited state of Si^{28} were also measured for proton energies above 3 Mev. Measurements were made with a gas scattering chamber containing silane (SiH_4) as the target gas. The elastic scattering data were analyzed in terms of the single-level approximation of the dispersion theory to determine the resonance parameters. This analysis, together with the analysis of the inelastic scattering cross sections and angular distributions, has resulted in the following assignments of resonance energies (Mev) and spins and parities for the resonance levels of P^{29}: 1.660 ($\frac{3}{2}^-$); 2.090 ($\frac{1}{2}^+$); 2.88 ($\frac{1}{2}^-$); 3.100 ($\frac{5}{2}^-$); 3.337 ($\frac{3}{2}^+$); 3.575 ($\frac{3}{2}^-$); and 3.711 ($\frac{3}{2}^+$). The large reduced elastic scattering widths of the p-wave resonances at 1.660 and 2.88 Mev suggest that these levels correspond to single-particle excitations of P^{29}. (auth)

10080

DIFFERENTIAL ELASTIC SCATTERING OF 14-MEV NEUTRONS BY Zn, Sn, Sb, Pb, AND Bi. L. A. Rayburn (Argonne National Lab., Lemont, Ill.). Phys. Rev. 116, 1571-4(1959) Dec. 15.

Differential elastic scattering cross sections in the angular interval from 10 to 165° were measured for Zn, Sn, Sb, Pb, and Bi. The experimental measurements are corrected for multiple scattering and the finite angular resolution by Monte Carlo methods. The corrected cross sections are compared with theoretical values computed by use of a complex potential with a spin-orbit term. (auth)

10081

NEUTRON-INDUCED FISSION CROSS SECTION OF Np^{237}. H. W. Schmitt and R. B. Murray (Oak Ridge National Lab., Tenn.). Phys. Rev. 116, 1575-7(1959) Dec. 15.

The neutron-induced fission cross section of Np^{237} was measured as a function of neutron energy in the range 0.9 to 8.0 Mev. Measurements above 1.7 Mev were made relative to the fission cross section of U^{238} using $2\pi^-$ counting of fission fragments from thin fissile deposits placed back to back in a gridded ionization chamber. In the range 0.9 to 2.8 Mev the energy dependence of the Np^{237} fission cross section was determined relative to the $T(p,n)He^3$ yield, and the results were normalized to those of the comparison counting experiment in the overlapping energy range. Results show that the cross section increases above threshold to a maximum value of 1.75 barns at ~2 Mev, decreases to 1.40 barns at ~5 Mev, and increases again to 2.14 barns at 8 Mev. Estimated uncertainty in the absolute magnitude of $\sigma_f(Np)$ is ±7%. (auth)

10082

SEARCH FOR LOW-ENERGY GAMMA RAYS IN O^{16}. William W. Pratt and Robert G. Cochran (Pennsylvania State Univ., University Park). Phys. Rev. 116, 1578-80 (1959) Dec. 15.

In the expectation that at least one low-energy transition from the fourth excited state of O^{16} may compete to an observable extent with the 7.11-Mev ground-state transition, a search was made for the 0.97 Mev ($1^- \rightarrow 3^-$) and the 1.05 Mev ($1^- \rightarrow 0^+$) gamma rays. Limiting values, $I(7.11)/I(0.97) \gtrsim 200$ and $I(7.11)/I(1.05) \gtrsim 370$, were found for the branching ratios. (auth)

10083

NEUTRINO DETECTION BY RESONANCE ABSORPTION IN CRYSTALS AT LOW TEMPERATURES. William M. Visscher (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 116, 1581-2(1959) Dec. 15.

An experiment is proposed wherein neutrinos emitted during electron capture by radioactive impurities in one part of a crystal may be resonantly absorbed by atoms in another part. Essential to the argument is the fact, recently experimentally proved by Mössbauer for gamma rays, that in an emission or absorption by a nucleus bound in a crystal at low temperature the recoil energy is often taken up by the crystal as a whole, with no phonons emitted or absorbed. Thus no energy is lost to recoil, and a neutrino emitted in a monoenergetic process has exactly the right energy to be resonantly absorbed in the inverse process. The feasibility of the experiment depends on the degree to which the electronic impurity levels are broadened relative to the natural width of the neutrino line. (auth)

10084

EXCITED STATES OF B^{13}. G. C. Morrison and J. A. Galey (Univ. of Chicago). Phys. Rev. 116, 1583-4(1959) Dec. 15.

The energy levels in B^{13} up to an excitation energy of 6 Mev were investigated by means of the reaction $Li^7(Li^7,p)B^{13}$ at an energy of 2 Mev for the incident Li^7 ions. Selection and identification of the outgoing protons in the presence of deuterons, tritons, and alpha particles emitted in competing reactions is achieved with a proportional counter-CsI(Tl) scintillation counter telescope system which gives a measure of the dE/dx and E of the emitted particle. From the observed energy spectrum of protons emitted at 90°, the Q-value of the reaction leading to the ground state of B^{13} was determined to be 5.97 ± 0.05 Mev in agreement with a previous measurement by Norbeck, and the energy of excitation of the first four levels in B^{13} were determined to be 3.70 ± 0.05 Mev, 4.16 ± 0.05 Mev, 5.05 ± 0.08 Mev, and 5.5 ± 0.1 Mev. At 90° in the laboratory system the relative intensities of the proton groups leading to the ground state and first four excited states are in the ratios of 1.0 : 2.6 : 0.8 : 1.6 : 1.0, respectively. (auth)

10085

DIFFERENTIAL CROSS SECTIONS FOR THE $Be^9(He^3,p)B^{11}$ REACTION. E. A. Wolicki, H. D. Holmgren, R. L. Johnston, and E. Geer Illsley (U. S. Naval Research Lab., Washington, D. C.). Phys. Rev. 116, 1585-91(1959) Dec. 15.

The differential cross sections for the six highest energy proton groups from the $Be^9(He^3,p)B^{11}$ reaction were measured as a function of angle at a bombarding energy of 4.5 Mev. For the five highest energy groups, the cross sections are largest in the forward direction and are not symmetric about 90°. For all six proton groups, yields observed at large angles to the incident beam direction are comparable to the forward yields. A strong maximum in the backward direction is observed for the third excited state proton group. At 4.5 Mev, the total cross sections are 11.5 millibarns for the ground-state proton group and

7.4 millibarns for the first excited state proton group. For the proton groups leaving B^{11} in the ground and first excited states, differential cross sections were measured at six angles as a function of bombarding energy in the range from 1.8 to 5.0 Mev. In each case, the total cross section for the reaction shows no resonances. The change in the angular distributions which may be inferred from these yield curves is seen to proceed in a gradual manner with increasing bombarding energy. Differential cross sections for the second and third excited state proton groups were measured at 7 and 90° in the bombarding energy interval from 3.0 to 5.0 Mev. The observed characteristics for this reaction taken together indicate that direct interactions are important. (auth)

10086

MUON CAPTURE BY C^{12} AND BETA DECAY OF B^{12}. G. Flamand (Princeton Univ., N. J.) and K. W. Ford (Brandeis Univ., Waltham, Mass.). Phys. Rev. 116, 1591-6(1959) Dec. 15.

The finite size of the carbon nucleus causes the K-orbit muon density within the nucleus to be smaller than the density for a point nucleus. Previously calculated muon capture rates in carbon should be reduced by about 6% for this effect. Our recalculated capture rate to the ground state of B^{12} does not differ greatly from previously calculated values. It is 7300 sec^{-1}, with an assigned theoretical error of about 10%. The result tends to support the Feynman-Gell-Mann proposal of a conserved vector current in the framework of a universal Fermi interaction. We give also various predicted correlation coefficients, which do not differ significantly from those of Wolfenstein. The allowed and all second-forbidden matrix elements were calculated as a function of the intermediate coupling parameter a/K. The beta-decay rate of B^{12} is predicted correctly for a/K = 4.5, a value which is close to that favored by other evidence. The calculated second-forbidden vector matrix element differs by 20% from the "experimental" value derived from a magnetic dipole transition rate in C^{12}.

10087

"NUCLEON-STRUCTURAL" CORRECTIONS TO FIRST FORBIDDEN UNIQUE BETA TRANSITIONS. J. F. Dreitlein (Washington Univ., St. Louis). Phys. Rev. 116, 1604-9(1959) Dec. 15.

The coupling of leptons to a conserved isovector current is shown to result in a small change in the shape of the electron momentum spectrum in forbidden unique beta transitions. The experimental advantages and disadvantages of studying such nucleon-structural effects in forbidden unique transitions rather than in allowed transitions, as suggested by Gell-mann, are discussed. To facilitate the computations, the beta-decay interaction Hamiltonian is written in a form in which the terms leading to the "nucleon-structural" corrections associated with the coupling of the leptons to a conserved isovector current and the terms leading to effects of comparable order of magnitude are simply identified. (auth)

10088

SUPERFLUIDITY OF NUCLEAR MATTER. R. L. Mills and A. M. Sessler (Ohio State Univ., Columbus); S. A. Moszkowski (Univ. of California, Los Angeles); and D. G. Shankland (Wright Patterson AFB, Ohio). Phys. Rev. Letters 3, 381-3(1959) Oct. 15.

A criterion for the superfluidity of infinite nuclear matter was given in the form of a variational principle by Copper, Mills, and Sessler (Phys. Rev. 114, 1377(1959)). Computations are reported which are an improvement over those in CMS in three respects: the effective mass approximation was removed, more realistic two-body potentials were employed, and superior trial functions were obtained. With the modifications it is concluded that the criterion is satisfied, and nuclear matter is superfluid. (W.D.M.)

10089

DISTORTED WAVE EFFECTS IN STRIPPING. J. A. Kuehner, E. Almqvist, and D. A. Bromley (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Phys. Rev. Letters 4, 132-4(1960) Feb. 1.

Measurements of the (p, γ) angular correlations for the reactions Si^{28}(d, pγ)Si^{29} (1.28 Mev) and Si^{29} (2.03 Mev) were made in the (d, p) reaction plane with the protons detected on the observed peak of the $l_n = 2$ stripping angular distributions. Assuming distorted-wave stripping, the data were fitted to the formalism of Huby et al. for which good agreement was obtained. (C.J.G.)

10090

ELECTRON PAIR PRODUCTION AT HIGH ENERGY IN A SILICON SINGLE CRYSTAL. G. Bologna, G. Diambrini, and G. P. Murtas (Comitato Nazionale per le Ricerche Nucleari, Frascati, Italy). Phys. Rev. Letters 4, 134-5 (1960) Feb. 1.

Electron pair production in a silicon single crystal was studied by means of a 1-Bev electron synchrotron γ beam. Data are presented showing the relative variation of the electron pair production cross section in silicon single crystals at 293°K vs. θ (the angle between the γ beam and the crystal axis [1 0 0]). The results were in good agreement with the calculations of Überall. (C.J.G.)

10091

UPPER LIMIT FOR THE ANISOTROPY OF INERTIA FROM THE MÖSSBAUER EFFECT. G. Cocconi and E. E. Salpeter (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Letters 4, 176-7(1960) Feb. 15.

It is shown that the Mössbauer effect can be used to study the anisotropy of inertia. The 14-kev γ transition in Fe^{57} is discussed as an illustration. An upper limit of $\sim 10^{-14}$ on the measurement of the anisotropy of inertia was determined. (C.J.G.)

10092

POLARIZED SPECTRA AND HYPERFINE STRUCTURE IN Fe^{57}. S. S. Hanna, J. Heberle, C. Littlejohn, G. J. Perlow, R. S. Preston, and D. H. Vincent (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 4, 177-80(1960) Feb. 15.

The polarization in the hyperfine spectrum of the resonant absorption of Fe^{57} was studied. The splittings of the excited and ground levels were determined to be 2.23 ± 0.03 mm/sec and 3.96 ± 0.10 mm/sec. The magnetic moment of the excited state was determined to be −0.153 ± 0.004 mm. A value of $(3.33 \pm 0.10) \times 10^5$ gauss was determined for the effective magnetic field at the nucleus. (C.J.G.)

10093

GAMMA WIDTH IN Be^8 PERTINENT TO A TEST OF THE CONSERVED VECTOR CURRENT THEORY. Dieter Kurath (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 4, 180(1960) Feb. 15.

The gamma transition width T_{MI} for the (J = 2, T = 1) (J = 2, T = 0) transition in Be^8 was calculated as a function of the relative strength of spin-orbit coupling to be 3 to 5 ev which approximately corresponds to +0.10 Weisskopf units. The experimental value was previously determined to be +0.02 ± 0.04. (C.J.G.)

10094

TIME SPECTRA OF FILTERED RESONANCE RADIATION OF Fe^{57}. R. E. Holland, F. J. Lynch, G. J. Perlow, and S. S. Hanna (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 4, 181-2(1960) Feb. 15.

An experiment employing the Mossbauer effect in Fe^{57} is described which illustrates the connection between the observed rate of decay of a nuclear state and the spectrum of the radiation with which the observation is made. (C.J.G.)

10095

EFFECT OF HARD CORES ON THE BINDING ENERGIES OF H^3 AND He^3. CORRECTED VALUES. Takashi Ohmura (formerly Kikuta) (National Research Council, Ottawa). Progr. Theoret. Phys. (Kyoto) 22, 34-40(1959) July.

There was an error in the kinetic energy formula of a previous paper by Ohmura (formerly Kikuta), Morita, and Yamada. The binding energy of H^3 as well as the Coulomb energy of He^3 are recalculated by using the correct value of the kinetic energy. The results obtained are almost the same. (auth)

10096

STRONG FERMI-TYPE INTERACTION AND ITS APPLICATION TO THE G_A/G_V RATIO IN β-DECAY AND THE ANOMALOUS MAGNETIC MOMENT OF NUCLEON. Chikashi Iso (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 62-72(1959) July.

The G_A/G_V ratio in β-decay and the anomalous nucleon magnetic moment are calculated on the basis of the compound model in which the elementary strong interactions are assumed to be the CP-invariant scalar, pseudoscalar, and tensor Fermi type couplings. In this model the P-invariance of strong interactions and the equality of the vector coupling constant of β-decay to that of μ-e decay are guaranteed automatically, and the experiment proposed by Gell-Mann is found to be useful as a test of the composite model. (auth)

10097

APPROXIMATE SOLUTION OF THE RELATIVISTIC TWO-BODY EQUATION AND ITS APPLICATION TO THE NUCLEAR FORCES. Hiroshi Yamamoto (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 22, 73-88(1959) July.

The approximate but analytical solutions of Bethe-Salpeter equation are given and the relations between binding energy and coupling constant are obtained. With the use of these solutions the validity of the non-relativistic approximation (i.e., neglect of retardation and recoil) is investigated. (auth)

10098

ON THE RELATIONS BETWEEN SPIN POLARIZATIONS AND DISTORTED WAVE THEORY OF THE DIRECT REACTIONS. Sueji Okai (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 89-100(1959) July.

The spin polarization in the distorted wave theory of stripping is presented in a general form, and the interesting problems are discussed, such as, what polarization comes from what types of the distortion of the wave functions. Under certain conditions, the exact relations are derived between the signs of polarization and the distortion of particle wave functions. It is pointed out that the similar relations are also present in other direct reactions. As an example, polarization in the inelastic scattering is studied briefly. (auth)

10099

STELLAR SYNTHESIS OF THE α-PARTICLE NUCLEI HEAVIER THAN Ne^{20}. Chushiro Hayashi, Minoru Nishida, Noboru Ohyama, and Hiroshi Tsuda (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 101-27(1959) July.

The rates of (α,γ) and (γ,α) reactions at temperatures above 5×10^8°K for α-particle nuclei, Ne^{20}, Mg^{24}, Si^{28}, S^{32}, Ar^{36}, and Ca^{40}, are calculated as well as heavy ion reactions such as $C^{12} + C^{12} \rightarrow Ne^{20} + \alpha$, etc. The stellar condition, under which the cosmical abundances of the α-particle nuclei can be explained in terms of the above nuclear reactions, is investigated by using these results. At high temperature $T = 2 \sim 3 \times 10^9$ °K the cosmical abundances of α-particle nuclei can be reproduced by taking the matter density ρ as $1 \sim 10^2$ g cm^{-3}. Such a stellar condition may be realized in the supernova explosion. It is shown that, to explain the cosmical abundances in concern by the equilibrium theory, $T > 5 \times 10^9$ °K and $\rho \sim 10^5$ g cm^{-3} are required. (auth)

10100

ORDINARY AND ANOMALOUS THRESHOLDS IN PERTURBATION THEORY. Noboru Nakanishi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 22, 128-44(1959) July.

Ordinary and anomalous thresholds of the matrix element corresponding to the general Feynman graph are rigorously investigated in detail. Necessary conditions for the ordinary threshold are obtained. (auth)

10101

DETERMINATION OF THE HALF LIFE OF THE SPONTANEOUS FISSION OF U^{238} FROM THE XENON CONTENT OF URANIUM MINERALS. E. K. Gerling, Yu. A. Shukolyukov, and B. A. Makarochkin. Radiokhimiya 1, 223-6 (1959). (In Russian)

Two pitchblende ores with a high xenon content were found to have an age of 2.3×10^8 years from an isotopic lead analysis. The age of three samarskite minerals was found to be 2.64×10^8 years from an isotopic helium analysis. The half life for the spontaneous fission of U^{238} was found to be $5.8 \pm 0.5 \times 10^{15}$ years, as derived from the xenon content of five minerals. (R.V.J.)

10102

APPLICATION OF γ RAYS EXCITED BY HEAVY CHARGED PARTICLES IN THE DETERMINATION OF ISOTOPIC ABUNDANCES. Ming-han Yeh and Cheng-wu Li. Wu Li Hsüeh Pao 14, 64-70(1958). (In Chinese)

Possibilities of using the γ rays excited by bombardment of an element with heavy charged particles to determine its isotopic abundances are discussed. Nuclear reactions and γ rays suitable for the determination of isotopic abundances of Li, B, C, and N are enumerated. (Sci. Abstr. China; Mathematical and Phys. Sci. No. 1, 1958, abstract No. 53.)

10103

COINCIDENCES CAUSED BY COMPTON BACKSCATTERING OF GAMMA-RAYS. Yung-chang Hsu and Lin-sheng Cheng. Wu Li Hsüeh Pao 14, 114-20(1958). (In Chinese)

With modification of a Rossi circuit, a coincidence circuit of resolving time 1.5×10^{-7} sec was built. Using this instrument, the annihilation radiations of small component β^+ rays emitted by Zn^{65} were investigated under various experimental conditions. The experiments demonstrate that the 0.21 Mev γ rays found previously in Zn^{65} may be the backscattered γ rays due to large component 1.12 Mev γ rays of Zn^{65}. The coincidence rate of collimated annihilation radiations gives the percentage of β^+ decay of Zn^{65} per total disintegration as $(1.5 \pm 0.1)\%$. (Sci. Abstr. China; Mathematical and Phys. Sci. No. 1, 1958, abstract No. 54.)

Particle Accelerators

10104 ANL-6032
Argonne National Lab., Lemont, Ill.
PARTICLE ACCELERATOR DIVISION SUMMARY REPORT [FOR] NOVEMBER 1958 THROUGH MAY 1959. Dec. 1959. 42p. Contract W-31-109-eng-38. OTS.

Work in the division is summarized in the areas of theoretical studies, model magnet studies, ring magnet vacuum chamber, vacuum pumping system, ring magnet power supply, radio-frequency system, injection system, theoretical studies on radial motion through the linac, outgassing, and ferrite bonding. (For preceding period see ANL-5956.) (W.D.M.)

10105 CERN-60-2
European Organization for Nuclear Research, Geneva.
UNE SOURCE DE PROTONS POLARISES—ETAT ACTUEL DE LA CONSTRUCTION. (A Polarized Proton Source—Actual State of Construction). R. Keller, L. Dick, and M. Fidecaro. Jan. 29, 1960. 64p.

The partial completion of a previously described (NSA, 11-13527) project is reported. The production of H atoms and formation of an intense atomic beam is described. The purpose of the long quadrupolar permanent magnet for primary separation of the $J = \frac{1}{2}$ and $J = -\frac{1}{2}$ states of the hyperfine structure is then pointed out. Finally, the ionization of a partially separated beam in a 4.5-Mev synchrocyclotron is discussed. (T.R.H.)

10106 MURA-554
Midwestern Universities Research Assn., Madison, Wis.
HIGH ENERGY NEUTRINO EXPERIMENTS WITH A HIGH INTENSITY FFAG ACCELERATOR. K. R. Symon. Jan. 15, 1960. 10p. Contract AT(11-1)-384. OTS.

It is shown that intense neutrino or anti-neutrino fluxes with a momentum resolution of ±7% can be produced with a high intensity FFAG accelerator. The fluxes are high enough to produce several events per hour in a hydrogen bubble chamber of reasonable size. Muon fluxes of 4×10^7 cm^{-2} sec^{-1} at 1 to 2 Bev with the same momentum can also be produced. (auth)

10107
THE CERN PROTON SYNCHROTRON. J. B. Adams. Nature 185, 568-72(1960) Feb. 27.

Design and performance of the CERN 25-Bev alternating gradient proton synchrotron are discussed. The CERN proton synchrotron accelerates protons to an energy which is about three times the energy of the largest accelerator now functioning. (C.H.)

10108
NIMROD, BRITAIN'S 7 Gev PROTON SYNCHROTRON. J. J. Wilkins and A. J. Egginton (National Inst. for Research in Nuclear Science, Harwell, Berks, Eng.). Nuclear Energy 14, 57-61(1960) Feb.

The design, construction, and characteristics of Britain's 7-Bev proton synchrotron are discussed. This machine is proposed to provide an output of 10^{12} protons/sec at a peak energy of 7 Bev. This corresponds to a proton velocity of 0.993 c. Initial tuning-up and operation are expected to begin in 1962. (B.O.G.)

10109
RADIATION SOURCES FOR INDUSTRY AND RESEARCH. HIGH VOLTAGE ACCELERATORS NOW IN WORLD MARKET. Nuclear Power 5, No. 46, 139-40(1960) Feb.

Basic types of accelerators for use as radiation sources are described and applications discussed. (C.J.G.)

10110
SHORT MAGNETIC LENS WITH DISTRIBUTED WINDING. V. M. Kel'man, B. P. Peregud, and V. I. Skopina (Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Tekh. Fiz. 29, 1219-24(1959) Oct. (In Russian)

A short magnetic lens with an assigned axially distributed field is described. The coil is wound in such a manner that the diameter of the turn does not exceed the diameter of the focused beam. An analysis is made of the characteristic parameters of three lenses. Their applications with beta spectrometers are discussed. (R.V.J.)

10111
STRONGLY-FOCUSING LENS WITH CYLINDRICAL POLES. I. A. Shukeilo. Zhur. Tekh. Fiz. 29, 1225-7(1959) Oct. (In Russian)

Evaluations are made of non-linear fields of strongly focusing lenses whose pole tip cross section is limited by a periphery arc close to a hyperbola, and the arc radii for fields with minimum non-linearity were determined. (R.V.J.)

10112
ON THE CALCULATION OF THE MAGNET OF CIRCULAR SYNCHRO-CYCLOTRON. V. N. Kanunnikov and A. P. Fateev (Lebedev Inst. of Physics, Moscow). Zhur. Tekh. Fiz. 29, 1228-34(1959) Oct. (In Russian)

The magnetostatic potential is used for establishing the necessary law of density variations in magnetic current along the radius of a magnet in an annular phasotron with distributed windings. The problem is solved with the assumption that the penetration of iron is infinite. The magnetostatic potential is also used in calculating field distortions caused by various discrepancies in current distribution induced by the boundary effect or other factors. (R.V.J.)

10113
INVESTIGATION OF NON-STATIONARY CURRENT IN BETATRON. D. P. Ivanov, A. P. Komar, and Yu. S. Korobochko. Zhur. Tekh. Fiz. 29, 1235-44(1959) Oct. (In Russian)

Data are presented from investigations of electron capture mechanisms in betatrons. The relationship between the magnitudes of non-stationary currents circulating in the betatron chamber during the capture time and the current emitted from the injector per mean number of electron cycles was established. The character of non-stationary current time changes was analyzed and the effects of various factors on the mean number of cycles and electron capture are discussed. The described method is of special interest for simplifying betatron adjustments and for fixing unsoldered betatron chamber. (R.V.J.)

Plasma Physics and Thermonuclear Processes

10114 AD-229672
Norair. Div. of Northrop Corp., Hawthorne, Calif.
MAGNETOGASDYNAMIC ACCELERATION OF FLOWING GASES AND APPLICATIONS. Sterge T. Demetriades. Mar. 23, 1959. 194p.

Previously circulated by the author under the title MAGNETOGASDYNAMIC ACCELERATION OF FLOWING GASES.

The theory of steady, inviscid, one-dimensional flow of a perfect conducting gas in magnetic and electric fields is developed with special emphasis on the basic assumptions

and the physical foundations of such flows. It is concluded that external electric and magnetic fields (acting along the z and y axes of a Cartesian coordinate system respectively) can accelerate a gas of high conductivity (0.1 to 100 mhos/cm) flowing along the x-axis to several times its initial velocity with moderate field strengths (ca 1000 gauss and 10 volts/cm). The properties of gases of interest in magnetogasdynamic flows are discussed with the emphasis on conductivity. Several successful methods are described for increasing the conductivity of air flows to the range where useful acceleration can be accomplished. Some speculative remarks are made on the feasibility of a magnetogasdynamic orbital ramjet and a magnetogasdynamic low-density hypersonic wind tunnel. The application of these principles to the Propulsive Fluid Accumulator (PROFAC) system for space flight is proposed, and the design considerations, advantages, and disadvantages are given. A preliminary design of a PROFAC system is also given. (auth)

10115 AFCRC-TN-59-555

Stanford Univ., Calif. Electron Devices Lab.

THE BENNETT PINCH. Technical Report No. 104-2. O. Buneman. June 17, 1959. 34p. Contract AF19(604)-1847. (AD-226921).

A fully covariant description of the Bennett Pinch is given, valid even for relativistic temperatures. A rigorous procedure is outlined for testing its stability with respect to all kinds of perturbation. (auth)

10116 LAMS-2381

Los Alamos Scientific Lab., N. Mex.

STABILITY OF A LINEAR PINCH. PART II. Bergen R. Suydam. Nov. 1959. 23p. Contract W-7405-eng-36. OTS.

This report supersedes LA-2149.

In Part I, published in Vol. 31 of the Proceedings of the Second International Conference on Peaceful Uses of Atomic Energy, a condition was found which was quite simple and yet quite stringent which is necessary for the stability of a linear pinch. The present paper continues the work to find conditions both necessary and sufficient for the stability of the hydromagnetic modes. The paper is mathematical in its nature and the results are stated as three theorems. (auth)

10117 PPL-120

Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N. Y.

SOME ENGINEERING ASPECTS OF THE MAGNETOHYDRODYNAMIC PINCH PROCESS FOR SPACE PROPULSION. Irving Granet and William J. Guman. Nov. 1959. 44p. Contract AF49(638)-552. (AFOSR-TN-60-86).

A description is given of four analytical models ("snow plow," "hydrodynamic," "slug," and "gasdynamic") in use for studying the plasma pinch. The equations and assumptions governing each model are given. An analysis of a space propulsion system was made with the "snow plow" model for various combinations of input parameters. It is concluded that during the first quarter cycle of current, the velocity and the momentum can be described in terms of instantaneous current, position, and total mass contained in the electrodes. For times very small compared to the quarter cycle time, all the models except "slug" yield similar results. Beyond the quarter cycle the velocity (of the "snow plow" analysis) can vary in an oscillatory manner but the instantaneous momentum is an ever increasing function. All maximum velocities of any given cycle fall along two straight lines which can be predicted from the basic equations of the model. For propulsion applications it was found that the gas mass should just leave the electrodes as the current passes through zero and the electric circuit should ring out on the fluid mass. (C.J.G.)

10118 R59SD453

General Electric Co. Missile and Space Vehicle Dept., Philadelphia.

PLASMA PROPULSION BY A RAPIDLY VARYING MAGNETIC FIELD. Milton M. Klein and Keith A. Brueckner. Dec. 2, 1959. 51p.

The motion of a plasma under the action of a rapidly varying magnetic field from a stationary coil was investigated for the diamagnetic case (ionization process ignored) and the non-diamagnetic case. For the diamagnetic case, a coupled set of non-linear differential equations was derived, put in similarity form, and solved for a wide range of similarity parameters. Calculations indicate that for field frequencies of about one megacycle, velocities of 10 cm/sec can be attained but the efficiency (5 to 10%) is too low for practical applications. Changes in the physical and geometrical parameters of the system increase the efficiency very little. An example of the non-diamagnetic system is presented to indicate the major differences to be expected. Efficiency of the non-diamagnetic system is slightly lower than the corresponding diamagnetic system. Due to the rapid leveling off of the ionization rate, the electron density rises only a few per cent during plasma motion. The degree of ionization occurring inside a plasma will produce little effect upon the efficiency of the system. It is concluded that for a plasma driven by a magnetic field from a stationary coil, the efficiency of the system is too low for practical applications. (auth)

10119 R59SD473

General Electric Co. Missile and Space Vehicle Dept., Philadelphia.

MAGNETOHYDRODYNAMIC CHANNEL FLOW OF A PERFECT GAS FOR THE GENERATION OF ELECTRICAL POWER. G. W. Sutton. Dec. 8, 1959. 34p. Contract AF04(647)-269.

The channel flow of an ideal compressible gas which is slightly ionized is considered for the purpose of generation of electrical power. For moderate temperatures, this implies conductivities of about 1 to 10 mho/cm so that the magnetic Reynolds number is small, and the externally imposed magnetic field then penetrates the gas completely. The electrical conductivity of the gas is taken as a function of temperature and pressure in accordance with well accepted theories, and the reduction in effective conductivity due to the Hall effect is considered. Analytical expressions are derived for the flow variables for flows of constant velocity, temperature, pressure, density, and area. On the basis of a comparison for constant electrical conductivity, the constant velocity flow seems the most desirable for power generation. (auth)

10120 AEC-tr-3995

ON THE CHARACTERISTICS OF CYLINDRICAL ARCS. H. Maecker. Translated for Oak Ridge National Lab. from Z. Physik 157, 1-29(1959). 71p. (Includes orig., 29p.). JCL.

The properties of cylindrical arcs with negligible radiation are essentially determined by the energy balance. A solution of the Elenbaas-Heller energy balance problem is presented in which $\sigma(S)$ enters as the only material function. The parameter σ denotes the electrical conductivity and S the function of heat conduction defined by $S = \int_0^T x\,dT$. The solution is a curve which, when approximated by a segment of abscissa and a suitable straight line, allows the integration of the differential energy balance. In this manner the radial temperature distribution, the arc character-

istic, and all other relations can be approached analytically. Two methods are cited for the suitable determination of the straight line, the preferable one being based on the method of least squares. A comparison of the results obtained in this manner with automatically integrated results demonstrates very good agreement not only for smooth initial curves but also for those of a more complicated nature. Rules for the determination of the straight line are derived with the aid of a few examples of application. (auth)

10121 CEA-tr-R-771

SPECTRES EN FONCTION DU TEMPS DU RAYONNEMENT DE LA DÉCHARGE À ÉTINCELLE DANS LES GAZ INERTES. (Spectra as a Function of Radiation Time of Spark Discharges in Inert Gases). M. P. Vanyukov (Vaniukov), A. A. Mak, and V. P. Muratov (Mouratov). Translated into French by B. De Trezvinsky from Optika i Spektroskopiya 6, 17-23(1959). 13p.

A spectrophotometric set-up with a 5×10^{-8} sec resolving time was used to study spectra of light from pulsed discharges in Ar, Kr, and Xe at 3.5 atm in the region 2500 to 5500 A. At the beginning of the discharge, when the light intensity is a maximum, a concentration of doubly ionized atoms takes place in the discharge channel. This effect is particularly noticeable for Xe. The spectral density of the energetic intensity of light depends very weakly on the wavelength. (T.R.H.)

10122

THE RATE OF STRONGLY ENDOERGIC THERMONUCLEAR REACTIONS. J. S. Cheng (Hua-Dong Normal Univ., Shanghai). Acta Phys. Acad. Sci. Hung. 11, 87-90 (1960). (In English)

A type of formula is suggested for the strongly endoergic thermonuclear reactions. It was derived for the calculation of the probability of various endoergic nuclear reactions which may occur within contracting stars without hydrogen, such as $He^4(\alpha,p)Li^7$, $He^4(\alpha,n)Be^7$, etc. (B.O.G.)

10123

RADIAL OSCILLATIONS AND STABILITY OF A CYLINDRICAL PLASMA. R. Pinte and R. Simon (Institut d'Astrophysique, [Paris]). Bull. classe sci., Acad. roy. Belg. 45, 595-610(1959). (In French)

A homogeneous, cylindrical, completely ionized plasma in equilibrium under the effect of its own gravity and in the presence of a longitudinal uniform magnetic field B_p is considered. The vacuum surrounding the plasma is supposed to be pervaded by a longitudinal uniform magnetic field B_v and by a toroïdal magnetic field caused by a sheet current flowing on the surface of the plasma. With the classical hypothesis of magnetohydrodynamics—scalar pressure, infinite electrical conductivity, and adiabatic changes—the dynamic stability of this equilibrium with respect to infinitely small radial perturbations is discussed. Application to the so-called pinch effect is obtained by neglecting gravitation in the general results. (auth)

10124

THE ROLE OF THE COLD EMISSION OF ELECTRONS BY FIELD EFFECT IN THE MAINTENANCE, AT THE CATHODE, OF THE ELECTRIC DISCHARGE IN VERY RAREFIED GAS. Henri Doucet. Compt. rend. 250, 1007-9(1960) Feb. 8. (In French)

The secondary emission of electrons, at the cathode, under the impact of positive ions is not sufficient to account for the maintenance of the electric discharge in very rarefied gas. The hypothesis of an emission by the effect of a field, under the action of the space charge caused by positive ions, is proposed and is found to be corroborated by the first experimental results. (tr-auth)

10125

MAGNETIC ROTARY POLARIZATION IN PLASMAS. APPLICATION TO THE MEASUREMENT OF THE ELECTRON DENSITY. Terenzio Consoli and Michel Dagal. Compt. rend. 250, 1010-12(1960) Feb. 8. (In French)

The rotation of a linearly polarized wave crossing a plasma layer is determined. A system of curves permits the application of these results to the measurement of the electron density of a plasma in evolution. (tr-auth)

10126

EXPERIMENTS WITH PLASMA RINGS. L. Lindberg, E. Witalis, and C. T. Jacobsen (Royal Inst. of Tech., Stockholm). Nature 185, 452-3(1960) Feb. 13.

A coaxial plasma gun with radial magnetic field was used for the production of magnetized plasma rings. A cross section of the apparatus is presented. The plasma was studied by means of high-speed photography, using Kerr-cell cameras, and by magnetic measurements. The magnetic flux carried by the plasma was measured by loops around the glass tube connected to integrating resistance-capacity circuits. (C.H.)

10127

GENERAL THEORY OF PLASMA. V. Ferraro (Queen Mary Coll., London). Nuovo cimento (10) 13, Suppl. No. 1, 9-58(1959). (In English)

A discussion of the dynamics of ionized gases following the macroscopic method of the kinetic theory of gases is presented. Molecular chaos is assumed, and only binary encounters between the particles are considered. A method of successive approximation for the Boltzmann equation for the velocity distribution function was formulated for the case when a characteristic length L is large compared to the mean free path l. Equations for a plasma and for calculation of the collision terms are given. The existence of a time of relaxation is explained by the effects of collision between oppositely charged particles. Expressions are presented for the calculation of electrical neutrality, collision interval and mean free path, electric currents, electrical and thermal conductivities at rest, and diffusion. Vorticity theorems are considered. Equations governing electrostatic, electromagnetic, and hydromagnetic waves in a plasma are presented. (C.J.G.)

10128

PLASMA PHYSICS ON COSMICAL AND LABORATORY SCALE. B. Lehnert (Royal Inst. of Tech., Stockholm). Nuovo cimento (10) 13, Suppl. No. 1, 59-110(1959). (In English)

The behavior of an ionized gas in cosmical observations and laboratory experiments is examined by means of dimensionless parameters. The deviations of experimental from theoretical calculations on electric neutrality and "creep diffusion" are estimated. The coupling between plasma and neutral gas is investigated by the basic equations for a partially ionized gas. This was found to give a dispersion relation for plane disturbances of small amplitudes. The effective electrical conductivity can be deduced from the corresponding damping distance. Agreement was obtained with the conclusions of Piddington and Cowling regarding the increased dissipation of magneto-hydrodynamic waves in the solar chromosphere and of magnetic fields in cool interstellar clouds. It was determined that magnetohydrodynamic oscillations with wave lengths comparable to the thickness of the ionospheric F_1 region and with periods comparable to those of "giant pulsations" are damped

moderately only if the ionization degree is about a hundred times greater inside than outside of the auroral zones. As an experimental illustration of the theory, torsional oscillations in a cylindrical "magnetohydrodynamic wave guide" are discussed. It was found that Alfvén waves will exist in an ionized gas in the laboratory only in a high-current discharge of relatively large dimensions. The diffusion processes which take place in a plasma column situated in a longitudinal magnetic field are discussed. Experimental data on the electric potential drop were found to agree well with the collision diffusion theory in a range of magnetic fields up to a certain critical value. Above this value a marked change occurs which can be interpreted as a sudden and rapid increase in the diffusion coefficient with a simultaneous rise in the noise level. These results support the "drain" diffusion mechanism proposed by Bohm, Burhop, Massey, and Williams—particle diffusion across the magnetic field is accelerated by the action of transverse electric fields. (C.J.G.)

10129

HIGH TEMPERATURE PLASMAS. P. C. Thonemann (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuovo cimento (10) 13, Suppl. No. 1, 111-31(1959). (In English)

Studies on the containment of turbulent constricted discharges in Ar and H by the simple pinch effect are reviewed. The electrical measurements which can be made on a plasma in the frequency range (0 to 10^6) Hz and measurements in the microwave and infrared frequency ranges are discussed. (C.J.G.)

10130

MICROWAVES IN A IONIZED GAS. A. Gilardini (Società Industrie Elettroniche, Rome). Nuovo cimento (10) 13, Suppl. No. 1, 132-65(1959). (In English)

A basic formula for plasma microwave conductivity is given, and the theoretical expressions for other basic plasma parameters which determine the behavior of an ionized gas (energy gain, distribution function, ionization and excitation frequencies, and average energies) are presented. The microwave breakdown condition, both in the absence and presence of a static magnetic field, is obtained and compared with experimental results. A review of the basic characteristics of the microwave sustained discharge is presented. The methods of measuring electron densities and collision frequencies by means of microwaves in resonant cavities are reviewed. (C.J.G.)

10131

THE STELLAR PLASMA. E. Schatzman (Institut d'Astrophysique, Paris). Nuovo cimento (10) 13, Suppl. No. 1, 166-88(1959). (In French)

The properties of stellar plasma are considered with respect to the Saha law, equations of state, and collective phenomena as the first part of a treatment of stellar plasma. The other parts deal with degenerate electron gases, the screen effect and thermonuclear reaction rates, thermonuclear reactions and mean path, temperature exchange, ion and electron temperature, role of the screen effect, and effect of electron cortege on α and β radioactivity and on spontaneous fission. (T.R.H.)

10132

STELLAR ATMOSPHERES AS A PLASMA. L. Biermann (Max Planck-Institut für Physik und Astrophysik, Munich). Nuovo cimento (10) 13, Suppl. No. 1, 189-204(1959). (In English)

Equations of motion and Ohm's law for an ionized gas in a stellar atmosphere are presented. Ambiguities in plasma physics relative to the solar atmosphere, sunspots, the heating mechanism of the chromosphere and the corona, and the state of ionization of the solar corona are discussed. The hydromagnetic ambiguities of interplanetary space are discussed relative to isorotation, force-free fields, densities, velocities, transport of angular momentum, magnetic fields, and comet tails. (C.J.G.)

10133

THE INTERSTELLAR PLASMA. H. C. van de Hulst. Nuovo cimento (10) 13, Suppl. No. 1, 205-33(1959). (In English)

Observational data and studies on material in the galactic system are reviewed. Mechanisms of radio emission are discussed relative to thermal radiation, synchrotron radiation, and the existence of non-thermal radiation. Observational data on the shell and the inner part of the Crab nebula are considered along with properties such as synchrotron radiation, energy spectrum, magnetic fields, and force-free fields. The temperature and motion of an interstellar gas and the observational evidence of interstellar magnetic fields are discussed. Interstellar plasma is discussed relative to magnetic fields, the expanding motion near the galactic nucleus, halo theories, and the energy budget of the interstellar gas as a whole. (C.J.G.)

10134

PROPAGATION AND PRODUCTION OF ELECTROMAGNETIC WAVES IN A PLASMA. R. Gallet (National Bureau of Standards, Boulder, Colo.). Nuovo cimento (10) 13, Suppl. No. 1, 234-56(1959). (In English)

General relationships for continuous waves and for a wave packet, relationships between ϵ, σ, n, and κ, and dispersion laws are discussed relative to the propagation of electromagnetic waves in a plasma. The characteristics of radio-wave emission from Jupiter are described. The possibility of solar radio emission of electromagnetic waves by plasma oscillations and the coupling mechanism of this emission are discussed. (C.J.G.)

10135

PLASMA CONFINEMENT BY EXTERNAL MAGNETIC FIELDS. J. G. Linhart (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 13, Suppl. No. 1, 257-83(1959). (In English)

An approximate theory on the diffusion loss of a plasma through the holes in a magnetic bottle is developed and applied to two cases; coaxial magnetic mirrors facing each other, and a quadrupole bottle. The problem of runaway electrons in plasma is discussed. The wave equation of electromagnetic oscillations is derived and applied to three confinements of a cylindrical plasma by magnetic fields; B_x I_θ pinch in which (e/mc) $B_x \gg \omega_p$; I_x B_θ pinch; and a combined B_x I_θ and $I_{x\theta}$ B_θ pinch. (C.J.G.)

10136

THE OBSERVABILITY OF HYDROMAGNETIC PHENOMENA ON THE SUN. K. O. Kiepenheuer (Fraunhofer Institut, Freiburg i. B.). Nuovo cimento (10) 13, Suppl. No. 1, 305-10(1959). (In English)

Hydromagnetic phenomena on the sun are discussed relative to the accuracy of magnetic field measurements and the limitations of observations on photospheric granulation, sunspots, chromospheric structures, flares, prominences, filaments, and corona. (C.J.G.)

10137

SOME THEORETICAL ASPECTS OF MAGNETO-HYDRODYNAMICS AND THERMONUCLEAR FUSION. R. Lüst (Max-Planck-Institut für Physik und Astrophysik, Munich).

Nuovo cimento (10) 13, Suppl. No. 1, 330-5(1959). (In English)

The confinement of a plasma by magnetic fields is discussed relative to magnetohydrostatic equilibrium, stability of the state of equilibrium against perturbations, and particle losses from the plasma enclosed by the magnetic field. (C.J.G.)

10138

THE EFFECT OF VISCOSITY ON THE STABILITY OF INCOMPRESSIBLE MAGNETOHYDRODYNAMIC SYSTEMS. A. Hare (University Coll. of North Wales, Bangor). Phil. Mag. (8) 4, 1305-10(1959) Dec.

A variational principle is derived, which may be used to discuss the stability of incompressible magnetohydrodynamic systems in the absence of viscosity, and its application is briefly described. The effect of viscosity is then discussed and comparison with the non-viscous case shows that conditions for stability derived in its absence are still valid. (auth)

10139

CONFINEMENT OF CHARGED PARTICLES BY PLANE ELECTROMAGNETIC WAVES IN FREE SPACE. Carsten M. Haaland (Armour Research Foundation, Chicago). Phys. Rev. Letters 4, 111-12(1960) Feb. 1.

Confinement of charged particles by oscillating electromagnetic fields occurs when ∇E^2 is normal to $\vec{E}$ and the magnetic field $\vec{B}$ is 90° out of phase with $\vec{E}$, and when ∇E^2 is parallel to $\vec{E}$. Both conditions are obtained in the region where two plane waves in free space intersect. (C.J.G.)

10140

OBSERVATIONS ON THE GENERAL SOLAR PLASMA INSTABILITY. L. Reiffel (Armour Research Foundation, Chicago). Phys. Rev. Letters 4, 136-8(1960) Feb. 1.

A discussion is presented on the existence and geometry of the solar plasma instability (the cosmic-ray barrier surrounding the inner solar system). Hydromagnetic processes, those involving an exchange of energy between the protons of the solar plasma stream and the accompanying electrons in the region of hydromagnetic turbulence, are considered. It is suggested that turbulent motion of the plasma streams into local regions of the disordered barrier, where the field is intense relative to surrounding regions, will create electrons of high energies through the Veksler process. The bremsstrahlung x rays produced by the energetic electrons are calculated to have a flux of 1.7×10^5 photons cm^{-2} sec^{-1} for a stream of volume 10^{37} cm^3. (C.J.G.)

10141

STABLE CONFINEMENT OF A HIGH-TEMPERATURE PLASMA. R. F. Post, R. E. Ellis, and F. C. Ford (Univ. of California, Livermore) and M. N. Rosenbluth (General Atomic [Div., General Dynamics Corp.,] San Diego, Calif.). Phys. Rev. Letters 4, 166-70(1960) Feb. 15.

Experiments on the stable confinement of a high-temperature plasma in a mirror machine are reported. The observed total confinement times ranged up to 10^5 times longer than theoretical instability times. The "classical" rate of radial collisional diffusion across the magnetic field was calculated to be 0 ± 40 cm/sec. An explanation given for the reported stability is that the field lines are tied down outside the plasma by the metallic coatings on the chamber walls. Interchange and "velocity-space" instabilities were investigated relative to the experiments. (C.J.G.)

10142

NOTES ON MAGNETO-HYDRODYNAMIC EQUILIBRIUM. Shigeo Hamada (Nihon Univ., Japan). Progr. Theoret. Phys. (Kyoto) 22, 145-6(1959) July.

An effect of rational surfaces in a stellarator was studied with varying rotational transform ratio. It can be shown that lines of current describe rapidly oscillating curves in the neighborhood of the rational surface. The diffusion velocity of fluids across magnetic lines increases due to the finite conductivity of fluids and the long paths of current lines in that region. A vortex flow may occur under some conditions. The diffusion effect will be small in practical cases, according to this semiquantitative treatment. (B.O.G.)

10143

ELECTRON MOTION IN SPACE-PERIODICAL MAGNETIC FIELD. V. D. Fedorchenko, B. N. Rutkevich, and B. M. Cherniy. Zhur. Tekh. Fiz. 29, 1212-18(1959) Oct. (In Russian)

Investigations were made of electrons moving in constant and weakly longitudinally modulated magnetic fields. With a definite "resonance" relationship between the electron velocity, the magnitude of the magnetic field, and the period of spatial modulation, the magnetic electron moment is not conserved and the energy is redistributed between the longitudinal and transverse component of the motion. (tr-auth)

10144

THEORY OF SOME MAGNETOHYDRODYNAMIC PHENOMENA OF THE FREE THERMAL LAMINAR CONVECTION OF AN ELECTRO-CONDUCTING LIQUID IN A VERTICAL CIRCULAR TUBE SITUATED IN A WEAK MAGNETIC FIELD. A. G. Smirnov (Gor'kii State Univ., Perm, USSR). Zhur. Tekh. Fiz. 29, 1245-51(1959) Oct. (In Russian)

The influence of a weak transverse magnetic field on the free thermal laminar convective motion in a conducting fluid is analyzed for the case when the magnetic action does not appreciably distort the flux. The distribution of induced electric current density across the tube in two cases of laminar convective motion is described. The maximum thickness of the boundary layer formed along the tube wall is about 10.6% of the tube radius in one case and about 42.3% for the second case. The total slowing down in the central region is stronger than the acceleration at the perimeter, resulting in magnetic striction. The vertical temperature gradient possible for free thermal laminar convection increases in proportion to the square of magnetic induction. The results are in good agreement with previous experiments made with mercury. (R.V.J.)

10145

CHARACTERISTICS OF HIGH-FREQUENCY MERCURY DISCHARGE IN A CONSTANT MAGNETIC FIELD. E. I. Vavilin, S. D. Vagner, and A. M. Drookman (Petrazavodsk State Univ.). Zhur. Tekh. Fiz. 29, 1263-70(1959) Oct. (In Russian)

The effects of axially constant magnetic fields on electron temperature, charged particle concentration, ion current density at the wall, and the transverse electric field in high-frequency mercury vapor discharges under various conditions were studied by a two-probe method. (R.V.J.)

10146

BIBLIOGRAPHY ON PLASMA PHYSICS AND MAGNETOHYDRODYNAMICS AND THEIR APPLICATIONS TO CONTROLLED THERMONUCLEAR REACTIONS. James D. Ramer, comp. College Park, Md., University of Maryland, [1959]. 107p.

A bibliography containing 1707 references is presented

on plasma physics and magnetohydrodynamics and their application to controlled thermonuclear reactions. (C.J.G.)

Shielding Calculations

10147 CEA-1186
France. Commissariat à l'Énergie Atomique, Paris.
ETUDE EXPÉRIMENTALE DE L'ATTENUATION DES NEUTRONS DANS LE BÉTON ORDINAIRE. (Experiments on Neutron-Attenuation by Ordinary Concrete). R. Beauge, J. P. Millot, and J. Rastoin. Apr. 1959. 16p.

The penetration of fission neutrons in water and glass mixtures has been investigated in the NAIADE facility. The slopes of the thermal and fast fluxes (the latter measured with a dosimeter) remain similar when the volume proportion of water is greater than 15 per cent. For smaller water contents the measurements show the evidence of streaming, presumably due to slowing-down neutrons of energy smaller than 300 kev. Since a volume-proportion of about 15 per cent of water in glass corresponds to the composition of ordinary concrete, the present work enables prediction of the effects of a dessication of concrete to be made. Moreover, it is seen that there is no interest in increasing the proportion of water in ordinary concrete beyond the usual values (15 to 20 per cent). (auth)

10148 CEA-1187
France. Commissariat à l'Énergie Atomique, Paris.
ETUDE EXPERIMENTALE DE L'ATTENUATION DES NEUTRONS DANS LES MELANGES PLOMB-EAU. (Experiments on Neutron Attenuation by Water–Lead Mixtures). R. Beauge, J. P. Millot, and J. Rastoin. May 1959. 20p.

The penetration of fission neutrons in water–lead mixtures has been investigated in the NAIADE facility. The slopes of the thermal and fast fluxes (the latter measured with a dosimeter) remain similar when the volume proportion of water is greater than 65 per cent. For smaller water contents, the measurements show the evidence of streaming presumably due to slowing-down neutrons of energy smaller than 300 kev. (auth)

10149 TID-3547
Technical Information Service Extension, AEC.
RADIATION SHIELDS AND SHIELDING. A Literature Search. Henry D. Raleigh, comp. Feb. 1960. 56p. OTS.

A literature search, containing 659 references, was prepared to serve as a reference guide until the completion of a formal bibliography supplement. References pertain chiefly to reactor shielding, but references on gamma and neutron attenuation, properties and effectiveness of shielding materials, biological shielding, shielding design and theory, etc., are also included. (W.D.M.)

10150 CEA-tr-A-660
COMPORTEMENT DE MATÉRIAUX DE PROTECTION CONTRE LES RADIATIONS GAMMA DES ISOTOPES RADIOACTIFS. (Behavior of Protective Materials Against Gamma Radiation from Radioactive Isotopes). H. Glubrecht. Translated into French from Strahlentherapie 102, 489-96(1957). 16p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6970.

10151
CRITERIA FOR SELECTION OF PRIMARY AND SECONDARY SHIELDING FOR A NAVAL REACTOR. A. M. Moncassoli and A. Massera (FIAT. Sezione Energia Nucleare, [Turin]). p.273-98 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

Criteria for selecting shielding for a naval PWR are pointed out, and the calculations involved in making the choice are shown. The results are tabulated. (T.R.H.)

Theoretical Physics

10152 AFOSR-TN-60-26
Vienna. Universität. Institut für Theoretische Physik.
ON THE RENORMALIZATION OF BETA COUPLING. Scientific Note No. 1. K. Baumann and A. Hõld. Nov. 17, 1959. 5p. Contract [AF]61(052)-265.

The renormalization of the vector and axial vector current is calculated for a single Dirac field which is coupled to itself. In the limit of small nonlocality the renormalization can be performed nonperturbationally. The vector and axial vector renormalization vectors were found to be greater than one. (J.R.D.)

10153 NP-8341
Washington Univ., St. Louis.
PROCEEDINGS OF THE MIDWEST CONFERENCE ON THEORETICAL PHYSICS. WASHINGTON UNIVERSITY, ST. LOUIS, MISSOURI, MARCH 14-15, 1958. 231p.

The Midwest Conference on Theoretical Physics was held at Washington University, St. Louis, on March 14 and 15, 1958. Four invited papers and seventeen contributed papers were presented. The papers and discussions following them are given. (W.D.M.)

10154 NP-8341(p.1-28)
FIELD THEORETIC METHODS IN SOLID STATE PHYSICS. J. Bardeen. 28p.

Problems in solid state theory are getting more difficult rather than easier, and the more tools that can be applied the better; it is clear that the very powerful methods developed by the field theorists should be quite useful in this connection. Several solid state problems are discussed to which field theoretic methods have been applied in the last few years. In particular: the polaron problem, the problem of the Coulomb correlation energy of an electron gas, and the superconductivity problem. (W.D.M.)

10155 NP-8341(p.39-43)
ON THE SCHWINGER VARIATIONAL PRINCIPLE FOR LAGRANGIANS LINEAR IN THE COÖRDINATE DERIVATIVES. S. T. Epstein. 5p.

It has been shown that when stated in a general form the principle very quickly leads to inconsistencies, especially when applied to L's which are linear in the coördinate derivatives. It is proposed that the spirit of the Schwinger principle be retained but to use it only in the first instance to derive the equations of motion and the commutation rules. (W.D.M.)

10156 NP-8341(p.44-77)
DEVELOPMENTS IN THE THEORY OF NUCLEAR STRUCTURE. K. M. Watson. 34p.

Several aspects of the subject of nuclear structure are reviewed. The phenomena discussed are related in that their interpretation has been given in terms of the so-called direct model of nuclear interactions, an interpretation typified on the one hand by the attempt to describe the dynamics of the nucleus itself in terms of equations involving interactions between pairs of particles and on the other hand, the attempt to describe nuclear scattering at high energies again in terms of a simple binary process. (W.D.M.)

10157 NP-8341(p.78-85)
THE LINKED CLUSTER THEOREM IN THE MANY BODY PROBLEM. F. Coester. 8p.

Certain aspects of the form of perturbation theory for many particle systems are discussed. A shell model eigenstate which is represented by a Slater determinant of single particle wave functions is associated with a large finite nucleus. The corresponding true eigenstate of the full nuclear Hamiltonian is also treated. (W.D.M.)

10158 NP-8341(p.107-12)
MAGNETIC MOMENT OF THE MOVING NUCLEON IN REPRESENTATIONLESS FORMALISM. H. Ekstein and D. Kaplan. 6p.

A pseudoscalar meson theory was examined in which the nucleons are treated non-relativistically but recoil is considered. The inhomogeneous term of the scattering amplitude was calculated to fourth order and the nucleon magnetic moment to second order in f. In both cases finite results were obtained even though the Hamiltonian was of a type called non-renormalizable. (W.D.M.)

10159 NP-8341(p.113-32)
THE KINETIC THEORY OF DENSE GASES. G. E. Uhlenbeck. 20p.

The problem of a dense gas in which the intermolecular force law is central and known is considered. The specific question discussed is can the general transport properties of the gas be calculated in terms of the intermolecular forces. (W.D.M.)

10160 NP-8341(p.133-41)
THE STATISTICAL MECHANICAL THEORY OF TRANSPORT. J. G. Kirkwood and S. A. Rice. 9p.

An approximate theory of transport for a liquid is considered. First it is assumed that it is possible to expand the gradient of the potential energy of the system at time t + s about that at time t and throw away all but the two lowest order terms in the expansion; second it is assumed that the distribution function can be approximated by one appropriate to local equilibrium; third it is assumed that the diffusion tensor in pair space can be represented as the direct sum of diffusion tensors in singlet space. (W.D.M.)

10161 NP-8341(p.142-7)
STATISTICAL MECHANICAL THEORY OF TRANSPORT PROPERTIES. I. Oppenheim. 6p.

An approach to a philosophy of irreversibility is sketched out which is very closely allied with Kirkwood's philosophy and which is in fact just a rather simple extension of it. It is shown how the basic ideas can be used to derive a generalized Boltzmann equation and, by making appropriate modifications, the ordinary Boltzmann equation. The philosophy involves explicitly the use of coarse-grained distribution functions, both in time and in configuration space. (W.D.M.)

10162 NP-8341(p.164-6)
REMARKS ABOUT VAN DER WAERDEN'S APPROACH TO SPINORS. H. Jehle. 3p.

The spinor notation with dotted and undotted indices was essentially developed by Van der Waerden and others. It has the advantage of ease of discussion of Lorentz invariance and of behavior under gauge and parity transformations. (W.D.M.)

10163 NP-8341(p.167-97)
A REVIEW OF WEAK INTERACTIONS. T. D. Lee. 31p.

A review of the present status of weak interactions is presented in terms of beta decay, muon decay, pion decay, K_{μ_2} decay, lepton conservation, hyperon decay, and the universal Fermi interaction. (W.D.M.)

10164 NP-8341(p.211-16)
CHIRALITY OF TENSORS AND RENORMALIZABLE THEORY OF WEAK INTERACTIONS. Y. Tanikawa and S. Watanabe. 6p.

Another possible form of weak interaction, as differentiated from the two-component theory of the neutrino and the universal Fermi interaction, is discussed. (W.D.M.)

10165 NP-tr-359
MODERN THEORY OF SUPERCONDUCTIVITY. (Souremennaya Teoriya Sverkhprovodimosti). A. Abrikosov and I. Khalatnikov. Translated from Uspekhi Fiz. Nauk 65, 551-91(1958). 60p. OTS.

The theory of superconductivity is outlined. The agreement of the theory deduced by the authors and other workers with experimental data was better than was a theory based on a model Hamiltonian with a four-fermion interaction. Various unexamined aspects of the theory such as the behavior of superconductors in magnetic fields and the possible existence of Bose-type excitations are also discussed. (J.R.D.)

10166
QUANTUM STATISTICS AS DISTRIBUTION OF MAXIMUM UNCERTAINTY. M. Castañs Camargo (Instituto de Electricidad y Automatica, Madrid). Anales real soc. españ. fís. y quim (Madrid), Ser. A 4, 305-8(1959) Nov.-Dec.

An intuitive meaning of Bose-Einstein and Fermi-Dirac statistics is obtained by maximizing γ (uncertainty or randomness) as applied to the number of particles per cell probabilities in the μ phase space. (auth)

10167
QUASI-PARTICLES AND COLLECTIVE STATES OF SPHERICAL NUCLEI. Robert Arvieu and Marcel Véneroni (Laboratoire de Physique Nucléaire, Orsay, France). Compt. rend. 250, 992-4(1960) Feb. 8. (In French)

A method analogous to that used by Bogolyubov in the study of collective excitations of a superconductor is applied to the case of a finite system with spherical symmetry. A hamiltonian considering pair correlations and capable of describing the collective modes of a system of fermions in interaction in a mean spherical potential is obtained. (tr-auth)

10168
INTERACTIONS WITH "INVERSION IMAGES" WITH RESPECT TO PM AND CT. Kuo-Hsien Tzou (Institut Henri-Poincaré, Paris). Compt. rend. 250, 995-7(1960) Feb. 8. (In French)

Fermion interactions with "PM or CT inversion images" are proposed. The consequences of the invariance of the image of these interactions are studied. (tr-auth)

10169
INVESTIGATION ON THE PROPERTIES OF $U(t,t_0)$ AND ITS LIMIT AT INFINITE TIME. Tse-sen Yang. Pei Ching Ta Hsüeh Hsüeh Pao-Tza Jan K'o Hsüeh 4, 175-89(1958). (In Chinese)

The limiting properties of the operator $U(t,t_0)$, which connects the state vector in the interaction representation of two different times, are investigated in detail. The limit of $U(t,t_0)$ can be obtained without introducing any adiabatic device. The special limit definition proposed by Gell-Mann and Goldberger is shown to be not a generalized definition from a study of a dynamical system of the following type. The total Hamiltonian H is separated into two parts, H_0 and V, where V is interaction, H_0 possesses the same con-

tinuous spectrum as that of H but in addition possesses discrete spectrum corresponding to bound states. It is shown that the solution in the interaction representation of the time-dependent Schrödinger equation with initial condition specified at $t = \pm\infty$ is not unique. Here the limit of $U(t,t_0)$ in formulating the formal theory of scattering was made in order to remove the ambiguities. The formal expression of $U(t,t_0)$ and its limit were generalized to comprise various forms of perturbation formalism of damping and scattering. The method consists of rewriting $U(t,t_0)$ into two "ϵ-expressions" by making use of the Laplace transformation of e^{-iHt}. (Sci. Abstr. China; Mathematical and Phys. Sci. No. 1, 1958, abstract No. 52.)

10170

STABILITY OF NUCLEAR MATTER. K. Sawada and R. M. Rockmore (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 1618-19(1959) Dec. 15.

The stability condition for a model of collective excitations of nuclear matter due to Glassgold, Heckrotte, and Watson is derived; it is shown that it may be satisfied for the actual parameters (nuclear radius, strength of potential, etc.). It is possible that nuclear matter is stable in their approximation, although there is no compressional collective mode. The stability condition seems to imply values of η, the radius parameter used by Karplus and Watson, equal to or smaller than those values obtained from their simple saturating nuclear model. (auth)

10171

ON AN AVERAGE NUCLEAR POTENTIAL FOR THE SHELL MODEL. Shi-shu Wu. Tung Pei Jen Min Ta Hsüeh—Tzu Jan K'o Hsüeh Hsüeh Pao No. 2, 277-88(1957). (In Chinese)

The average nuclear potential H_h for the shell model was calculated for He^5, assuming a bound state for the lowest virtual states $^2P_{\frac{3}{2}}$ and $^2P_{\frac{1}{2}}$. (Sci. Abstr. China; Mathematical and Phys. Sci. No. 1, 1958, abstract No. 57.) (C.J.G.)

REACTOR TECHNOLOGY

General and Miscellaneous

10172 ANL-6073

Argonne National Lab., Lemont, Ill.

ADVANCED DESIGNS OF MAGNETIC JACK-TYPE CONTROL ROD DRIVE. Joseph N. Young. Nov. 1959. 149p. Contract W-31-109-eng-38. OTS.

The magnetic jack is a device for positioning the control rods in a nuclear reactor, especially in a reactor containing water under pressure. Magnetic actuation precludes the need for shaft seals and eliminates the problems associated with mechanisms operating in water. It consists of a pressure shell, four sets of external stationary magnet coils (hold, grip, lift, pull down), and one internal moving part (armature) that imparts linear motion to a cluster of rods. (W.L.H.)

10173 ANL-6110

Argonne National Lab., Lemont, Ill.

ARGONAUT AUTOMATIC FLUX CONTROLLER DESIGN REPORT. A. Gerba, Jr. Jan. 1960. 37p. Contract W-31-109-eng-38. OTS.

The purpose of designing an automatic flux controller for a training-research reactor and the usefulness of the equipment as a pedagogical tool are discussed. The design is presented in the form of a steady-state analysis based upon the small-signal linearization of the reactor kinetics transfer function. The measured controller performance and construction details of the equipment are given. (auth)

10174 CEA-1172

France. Commissariat à l'Énergie Atomique, Paris.

EMPILEMENT POUR LE CONTROLE DE L'ABSORPTION DE L'URANIUM. (Uranium Absorption Study Pile). V. Raievski and B. Sautiez. Mar. 1959. 59p.

A pile is described which is designed to measure the absorption of fuel slugs. The pile is of graphite and comprises a central section composed of uranium rods in a regular lattice. RaBe sources and BF_3 counters are situated on either side of the center. A given uranium charge is compared with a specimen charge of about 560 kg, and the difference in absorption between the two noted. The sensitivity of the equipment will detect absorption variations of about a few ppm boron (10^{-6} boron per gr. uranium) or better. (auth)

10175 CF-60-1-24

Oak Ridge National Lab., Tenn.

EVALUATION OF ACTIVATED CHARCOAL FISSION GAS ADSORBERS DESIGNED FOR THE GC-ORR LOOP EXPERIMENT NO. 1. R. E. Adams and W. E. Browning. Jan. 14, 1960. 20p. OTS.

The activated charcoal traps designed for the Gas-Cooled Oak Ridge Research Reactor Loop Experiment No. 1 are evaluated for room temperature operation involving the decontamination and atmospheric disposal of helium coolant gas contaminated by experiment failure. The maximum quantity of fission products expected to be released was calculated and the resulting hazard was examined on the basis of probable radiation doses to laboratory personnel resulting from exposure to the gas cloud. The release was postulated to have occurred during adverse meteorological conditions when the efficiency of the gas disposal stack was low. Even though these assumptions are intended to make the estimate maximal, the probable total body radiation dose was determined to be 0.55 mr. Therefore, the consequences of atmospheric disposal of fission products, mainly krypton, passing through the charcoal traps do not appear serious. (auth)

10176 IDO-16580

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR-ETR TECHNICAL BRANCHES QUARTERLY REPORT FOR PERIOD ENDING SEPTEMBER 30, 1959. Jan. 26, 1960. 59p. Contract AT(10-1)-205 OTS.

In the reactor technical assistance program, it has been shown that the fuel content of the ETR control rods can be increased by 75% to give a generated power increase (in a control rod) of 50% and a typical increase in excess reactivity of 0.55%, without exceeding heat transfer limitations. A metal fabrication facility was completed for developing and fabricating sample fuel plates for local research programs. Hydraulic tests on experimental thin-plate narrow-channel fuel elements showed flow distribution improved over that of conventional MTR fuel elements. In the search for stronger alloys to make possible elements having thinner plates, comparative strength tests were made on plates of 6061 and 1100 aluminum alloys (in the fully-annealed condition); results are reported. Oxidation rates for an aluminum-uranium sample exposed to water vapor have been shown to follow a linear rate law within close limits. A method has been developed for use of the RMF to determine effective cross sections in terms of neutron density, cadmium ratio, and characteristic neutron temperature. This method makes it possible to determine for a sample,

by a reactivity measurement, parameters which can be used to express effective cross sections for the sample in other reactor spectra, provided their neutron temperature and 1/v cadmium ratio are known. Low energy (<5ev) measurements on the total and fission cross sections of U^{233} and the total cross section of Pa-231 have been completed. Eta measurements of U^{233} are continuing on the crystal spectrometer with modified long-counter and $MnSO_4$ fast neutron detection. The shielded sample changer for radioactive samples was installed on the fast chopper and the background-reducing characteristics of quartz filters have been studied. The results of the fission mass yield study of Pa^{239} as a function of neutron energy are reported. In the inelastic scattering program additional measurements have been made on water and on a Ge single crystal. Studies on the decays of Dy^{165} and Eu^{156} have led to proposed preliminary decay schemes. A 4π beta-gamma coincidence counting system with a resolving time of 3.90 μsec and a unit efficiency of 99.9% has been placed in operation. Also operating is the 144-channel memory for the pulse height analyzer, with completion of the readout operation and controlling functions. Progress has been made in using the IBM-650 for Monte Carlo calculations. Inclusion of secondary collisions may change the conclusions reached when this process was neglected. (For preceding period see IDO-16561.) (auth)

10177 MND-C-2200

Martin Co. Nuclear Div., Baltimore.

ANPP CODE DEVELOPMENT PROGRAM PRESSURIZED WATER TASK QUARTERLY PROGRESS REPORT NUMBER ONE. [Period covered]: August 1 through October 31, 1959. T. M. Olsen, L. Welshans, and C. Eicheldinger. Nov. 1959. 106p. Contract AT(30-1)-2431. OTS.

The objective of the program is the development of a nuclear physical model and its calculation code for pressurized-water-cooled and -moderated reactors to predict accurately reactivity, rod positions, and power distributions at operating temperatures and reactor life from a nuclear standpoint. The BENIKO and RSP physical models for calculating buckling and reflector savings coupling coefficients for synthesis were revised, extended, and combined for improved accuracy, flexibility, and convenience under the new name, BRAVE. Program C was modified to eliminate the assumption of the validity of using a bare core slowing-down spectrum and to correct for inelastic scattering in stainless steel, and renamed Program M. Program F was modified to calculate adjoint fluxes, to include extra lattice intervals, and to include the option of spherical geometry, and was renamed Program T. Characteristics and current status of 15 machine codes of interest are presented. The details of automating the BRAVE, M, and T calculations were developed. The resulting linkage of these three programs is called SYNFAR, for "Synthesized Flux and Reactivity Calculation." The Nuclear FORTRAN Library Tape System was revised for increased efficiency and ease of operation. A FORTRAN subroutine, called CHANGE, for making efficient changes in a few of the input data of a case without reading in all of the data, was written and checked out. A FORTRAN subroutine for changing the tape unit numbers used in an IBM-704 FORTRAN program, without reassembly, was written and checked out. A scheme was developed for reading basic cross-section data from experimental curves using Benson-Lehner equipment and generating a basic cross-section data tape from this information. A FORTRAN program was outlined and started for generating a multigroup cross-section production data tape from the basic data tape. A FORTRAN program for applying the Breit-Wigner formula to fill in gaps in the experimental data was written and check out was started. Use of the Benson-Lehner equipment to read and convert the basic curvilinear data to punched card form was started for U^{235}. Critical experiments were performed on two cores. In the first core, critical buckling measurements were performed using gold, thorium, and dysprosium foils and the fuel plate scanning technique. Analytical buckling and reflector savings were compared with the experimental values. The thorium data agreed within five per cent; poor correlation was obtained using the other materials and techniques. Experiments performed on the second core were: multiplication runs to criticality; control rod calibration; fuel and boron worth determinations; and three-axes buckling measurements. Plans for the homogeneous element substitution experiments were advanced. Two types of homogeneous elements are expected to be utilized: one in which all materials in a reference element are homogenized; and a second type in which a single material, (boron or uranium), is homogenized. (See also MND-E-2119). (auth)

10178 NAA-SR-4059

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

NEUTRON THERMALIZATION IN A HEAVY MODERATOR WITH AN ABSORPTION RESONANCE. E. R. Cohen, M. N. Moore, and E. U. Vaughan. Mar. 15, 1960. 21p. Contract AT-11-1-GEN-8. OTS.

The neutron velocity spectrum resulting from interaction of a high-energy neutron source with a spatially infinite, heavy gaseous moderator is obtained by solution of the Wilkins equation for the case of 1/v absorption cross section plus a single sharp resonance. The resonance is assumed to be narrow enough so that variations in the flux through the resonance are small with respect to the average flux in the resonance, yet broad with respect to the average energy loss per collision. The resonance escape probability and the effective resonance integral are defined and calculated. It is shown that the effect of the thermal motion of the moderator on the effective resonance integral can be expressed, in first order, as a correction to the mean logarithmic energy loss per collision. This correction, which can be described as the contribution of energy transfer from moderator to neutron, is the same as the one proposed by Cohen, and increases the resonance integral by ten per cent even for resonance energies as high as 20kT. (auth)

10179 NAA-SR-4769

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR SAFETY DEVICE RELIABILITY DETERMINATION USING SEQUENTIAL ANALYSIS. S. H. Fitch. Feb. 15, 1960. 26p. Contract AT-11-1-GEN-8. OTS.

Statistical analysis is applied to the problem of the reliability of safety devices for nuclear reactors. The techniques of sampling and statistical inference are described. A program of device reliability testing is formulated based on the procedures of sequential analysis. The reliability program calls for the manufacture of 30 safety devices as a pilot production run. Some devices will be exposed to a reactor environment for several months. Others will accumulate time for "shelf-life." Finally, the devices will be tested by reactor transients in the SPERT-I facility. The sequential analysis technique is shown to prove a device reliability with a fairly high degree of confidence in that value. As with any technique of statistical inference, there is a degree of uncertainty in the result. The amount of this uncertainty is controlled. The test program is designed to

show a device reliability of 95% with a confidence level of 95%. (auth)

10180 NYO-2675
TRG, Inc., Syosset, N. Y.
HETEROGENEOUS REACTOR CALCULATION METHODS. Quarterly Progress Report No. 3 [for] October 1–December 31, 1959. Carl N. Klahr, Lawrence B. Mendelsohn, and Jerome Heitner. 58p. Contract AT(30-1)-2375. (TRG-129-QTR-3). OTS.

The digital computer code for heterogeneous reactor calculations was completed and debugged. HERESY is an IBM-704 code for the calculation of reactivity and relative thermal neutron absorptions of representative rods within heterogeneous reactors. Three series of heterogeneous reactor physics calculations were carried out using HERESY 1. Significant results include: (a) the variation in reactivity and power pattern as a large array of rods is gradually built up from a smaller array; (b) a study of power flattening in spiked cores, in which the average-to-maximum power ratio is varied considerably as the distribution pattern of enriched rods within an array is changed; and (c) the sensitivity of the results obtained by self-consistent heterogeneous procedure is found to be only weakly dependent on errors in the kernels. (For preceding period see NYO-2674.) (W.D.M.)

10181 ORNL-2199
Oak Ridge National Lab., Tenn.
INVESTIGATION OF FLUID FLOW IN THE ART AND OTHER REFLECTOR-MODERATED REACTOR CORES. G. L. Muller, J. O. Bradfute, and F. E. Lynch. Apr. 16, 1958. Decl. Nov. 24, 1959. 148p. Contract W-7405-eng-26. OTS.

The turbulent flow of liquid through ART reflector-moderated reactor cores of annular cross section was studied because of the need to obtain a steady flow exclusive of the normal unsteadiness of turbulent flow in ducts. Studies were made of water flowing through quarter-scale transparent plastic models of the cores so that flow visualization techniques could be used in the work. An extensive series of tests of many core systems was made over a range of Reynolds moduli based on core midplane dimensions and axial flow rates up to ~90,000. Analyses were made of velocity and static pressure data obtained on a full-size ART core model with several different entrance conditions. (W.D.M.)

10182 ORNL-2886
Oak Ridge National Lab., Tenn.
VIEWING EQUIPMENT FOR USE IN THE HRT CORE AND BLANKET VESSELS. J. S. Culver. Mar. 15, 1960. 21p. Contract W-7405-eng-26. OTS.

Several viewing devices were built or purchased and various viewing aids were developed to permit examination of the core vessel of the Homogeneous Reactor Test. The hole in the core vessel was viewed and photographed from both the inside and the outside. A number of simple periscopes were designed and fabricated. A small television camera was purchased, and manipulators were built to insert it in the core or in the blanket. A radiation-resistant 21-ft-long periscope was procured which is ⅛ in. in diameter and has a 180° field of view. (auth)

10183
FUEL CYCLES IN TWO-REGION HOMOGENEOUS REACTOR. K. Matsuoka, S. Terasawa, and H. Nishibori (Hitachi Ltd. Central Research Lab., Japan). J. Atomic Energy Soc. Japan 2, 15-23(1960). (In Japanese)

The ways of converting a two-region aqueous homogeneous reactor fueled with 20% U^{235} enriched uranium into a U^{233}-breeder are discussed. Numerical solutions are obtained for the burn-up equations combined with a one-group criticality condition and constant total power out-put. The "batch method" and the "continuous method" are compared. Time-dependent changes in the concentrations of individual isotopes, the number of uranium isotopes supplied to the core and removed from the blanket, the chemical processing rate, the ratio of the power produced in the blanket to that in the core, and the effect of U^{233} concentration in the blanket on these quantities are discussed for both cases. (auth)

10184
CIRCULAR GRILLAGES, THEIR DESIGN AND ANALYSIS. R. K. Livesley (Cambridge Univ., Eng.). Nuclear Eng. 5, 116-19(1960) Mar.

Design characteristics of square-mesh grillages with circular boundaries, such as are used in reactors for supporting the graphite stack, are considered. For this particular design the load on the supporting skirt tends to be concentrated at points 45° to the direction of the beam. Designs calculated to overcome this fault are examined. (B.O.G.)

10185
A VECTOR DIAGRAM FOR REACTOR CHANNEL TEMPERATURES. P. R. J. French (AEI-John Thompson Nuclear Energy Co., Ltd., Knutsford, Ches., Eng.). Nuclear Eng. 5, 120-2(1960) Mar.

Vector analysis is utilized to explain that the axial distribution of heat generation in a cylindrical core with vertical coolant channels is approximately sinusoidal. Temperatures can be plotted by means of these illustrated vector diagrams to explain that as the heat flows radially outward through the fuel and across the interface between the fuel and the can, there is a radial temperature drop proportional to the local heat rating of the fuel. The radial flow of heat varies along the channel in the same way as the temperature difference between the can and the coolant. The heat generation from a core with end reflectors is discussed. (B.O.G.)

10186
FLUX PERTURBATION BY DETECTOR FOILS. Alain Sola (Argonne National Lab., Lemont, Ill.). Nucleonics 18, No. 3, 78-81(1959) Mar.

An experiment to determine the flux perturbation for circular gold foils in graphite was conducted and compared to existing theories. These experimental results indicate that analytical methods of predicting flux perturbations by foils in a thermal spectrum are valid over a wide range of foil dimensions. (B.O.G.)

10187
CALCULATING GAMMA SPECTRA FROM REACTORS. R. L. French (Convair, Fort Worth, Tex.). Nucleonics 18, No. 3, 114; 116-17(1960) Mar.

A method was developed for calculating the gamma spectrum and dose rate from an operating reactor. This method provides reliable results for shielding and heating calculations. Direct use is made of "differential energy spectra" for point, isotropic, and monoenergetic gamma sources in infinite media. The practicality of the application is that differential energy spectra are available for a wide range of materials or may be interpolated on the basis of atomic number or "effective atomic number" for any material. (B.O.G.)

10188
RECENT EXPERIMENTAL AND ANALYTICAL STUDIES OF SAFETY OF NUCLEAR REACTOR OUTER CONTAIN-

MENT STRUCTURES. Wilfred E. Baker (Ballistic Research Labs., Aberdeen Proving Ground, [Md.]). p.165-76 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

It was found possible to predict analytically the response of spherical containment shells to transient internal pressures caused by reactor runaway. Both the elastic and plastic response of such shells can be accurately predicted, as shown by the results of small scale experiments which were performed to compare with theory. Measurements of the response to simulated reactor runaway of shells of typical containment structure geometry are presented. The character of the response was compared to response of the same shells to internal static pressure, and was shown to be entirely dissimilar. A discussion is presented of the implications of the results of the program, and some suggestions for design of outer containment structures. (auth)

10189

ON THE DETERMINATION OF THE MAXIMUM PERMISSIBLE LEAKAGE RATE OF REACTOR CONTAINMENTS. H. I. Brüchner (Allgemeine Elektrizitäts-Gesellschaft (A.E.C.), Ger.). p.177-96 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

An accident is assumed and calculations are made to determine the maximum allowable leakage rate of a reactor containment vessel. Primary circuit and canning rupture fission products are released to the atmosphere of the reactor building. Consideration is given to the amount of active material in the core, the amount released, the nature of the containment shell leaks, external dispersal of active material, and effect of radiation exposure. An equation for L_{max} is derived which will give values both for thyroid-seeker and bone-seeker radioisotopes. This equation is then applied to the first German power reactor under construction at Kahl/Main. (T.R.H.)

10190

INHERENT SAFETY OF AQUEOUS HOMOGENEOUS RESEARCH REACTORS. Marlin E. Remley (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.311-28 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Experiments with the Kinetic Experiment Water Boiler are described which demonstrate the inherent safety of aqueous homogeneous research reactors. Transient power excursions were initiated under a wide variety of conditions, and all were controlled by the reactor's self-limiting characteristics. This self-regulation results from the large negative temperature coefficient and the additional coefficient from radiolytic gas formation. (T.R.H.)

10191

BURNUP VERSUS ENRICHMENT. Oskar Löbl (Rheinisch-Westfälisches Elektrizitätswerk-Aktiengesellschaft, Essen). p. 529-38 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Higher burnup values with higher fuel enrichments are considered. The position that enrichment greatly influences burnup is attacked. (T.R.H.)

10192

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. William Fairhurst (to United Kingdom Atomic Energy Authority). British Patent 829,037. Feb. 24, 1960.

A fin configuration for fluid-cooled reactors is described. Extruded longitudinal fins are slotted and the portions between slots are bent to deflect coolant around the fuel element as it moves along. (T.R.H.)

Power Reactors

10193 BAW-1102

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

NUCLEAR MERCHANT SHIP REACTOR PROJECT QUARTERLY TECHNICAL REPORT [FOR] JANUARY 1958–MARCH 1958. Changed from OFFICIAL USE ONLY Mar. 1959. 169p. Contract AT(30-3)-274. OTS.

The basic design of the waste collection and drain system was completed. Only the control panel, the radiation monitoring system, the control system, and the refueling system required further basic design work. A recent modification to the purification system was the elimination of the flash tank, which permitted several improvements in this system. A flow diagram covering the primary and major auxiliary systems is included. The core design was changed from 192 rods per fuel element in one assembly to 164 rods per element in four subassemblies. The total number of fuel elements remains unchanged at 32. The fuel enrichment necessary for the target lifetime remains 4.0%. On February 6, 1958, clean criticality of the NMSR critical experiment Core I was achieved using 1436 fuel rods enriched to 4.0%. Subsequent experiments included control rod evaluations, rod follower worth, water height measurements, flux and power traverses, and other physics parameters. A preliminary reactor flow reversal study was completed with some very conclusive results. The flow rate with only one pump running at half speed is above the stagnation point. Hence, flow reversal is practically impossible under any normal operating conditions. In the region where flow reversal has a reasonable probability (below 35% flow), the upflow is sufficient to prevent burnout. A preliminary analysis of the total loss of pumping accident with immediate reactor scram was also completed. These results indicate that the clad surface temperature remains well below the melting range even with the many conservative assumptions factored into the calculation. A recent study indicated the need for a redesign of the control rod nozzles because of excessive temperature gradients. There is a consideration to undercut the duplex nozzle wall to provide an air gap and a multilayer liner in the buffer seal housing. Structural additions to the drive line test facility were completed and fabrication of the test vessel was continued. One analog simulation study, the continuous rod withdrawal, was completed and a second, the startup accident study, is nearly finished. Test specimens for determining the mechanical properties of the fuel rod and attachments were fabricated and tested under atmospheric and reactor operating conditions. Test apparatus and specimens to determine the mechanical properties of the fuel rod bundle were designed and construction was begun. Apparatus and specimens for testing the mechanical properties of the fuel element container were fabricated and tested. The reactor vessel model flow test apparatus is also under construction. Fabrication development for cold pressing commercially available UO_2 powders into pellets of required density and dimensions continued. The irradia-

tion testing program of UO_2 clad in type 304 stainless steel was continued by pellet, container, and specimen holder fabrication for dynamic loop testing. Capsule design is underway for static testing, and a bundle design and production schedule was prepared for specimens to be irradiated at VBWR. (For preceding period see BAW-1042(Rev.).) (auth)

10194 CEA-1106
France. Commissariat à l'Énergie Atomique, Paris.
THERMAL FLUX FLATTENING AND INCREASE OF REACTOR OUTPUT. J. Horowitz and J. Bussac. 1959. 9p

It is worthwhile, when building power reactors, to have an excess reactivity in order to increase rating by fitting closely together the heat sources and the cooling possibilities. The power per unit volume of a graphite reactor can then be increased, given the power of the most heavily loaded channel. The solutions adopted for G1, G2, and EDF1 are described here, and also the improvements based on the actual neutron flux flattening, the introduction of several zones for the coolant, the variation of uranium rod and coolant channel diameters according to their location, and finally the change in lattice pitch. The perturbation of neutron flux due to variation of mean absorption in the lattice is also discussed. (auth)

10195 CF-60-2-18
Oak Ridge National Lab., Tenn.
HAZARDS OF NUCLEAR POWER UNITS IN SPACE APPLICATIONS. P. G. Lafyatis. Feb. 5, 1960. 7p. Contract [W-7405-eng-26]. OTS.

A review of hazards arising from the use of nuclear power plants in space applications is presented. Hazards to the general population in launch and return operations are considered along with those for the vehicle occupants. (J.R.D.)

10196 CF-60-2-30
Oak Ridge National Lab., Tenn.
OBSERVED HEAT TRANSFER IN HRT FUEL AND BLANKET HEAT EXCHANGERS. P. N. Haubenreich, H. B. Piper, S. R. Buxton, and J. R. Engel. Feb. 8, 1960. 15p. OTS.

Data obtained during power operation of the HRT indicates that during the circulation of fuel solution at high temperatures for more than 260 days, there was a small increase in heat transfer resistance in the heat exchangers. (The increase in resistance corresponds to a scale coefficient of about 2000 Btu/hr-ft^2-°F.) The change in heat transfer correlates with the increase in the amount of corrosion product solids in the reactor fuel system. (auth)

10197 IDO-28542
Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM SEMIANNUAL PROGRESS REPORT [FOR] JANUARY 1 THROUGH JUNE 30, 1959. July 31, 1959. 151p. Contract AT(10-1)-880. OTS.

The Army GCRS program includes the Gas Cooled Reactor Experiments I and II, the ML-1 (a portable gas-cooled reactor), and the Gas Turbine Test Facility. The design criteria, testing programs, data evaluation, and fabrication programs of these projects are covered. The scope of the report includes architect-engineering services, fuel element development and fabrication, materials development, experimental heat transfer, reactor instrumentation, reactor design and development, and nuclear experiments. The activities of the program under the four areas of responsibility are discussed. (For preceding period see IDO-28533.) (W.D.M.)

10198 MND-M-1852
Martin Co. Nuclear Div., Baltimore.
PM-1 NUCLEAR POWER PLANT PROGRAM; PARAMETRIC STUDY REPORT. J. S. Sieg. Sept. 1959. 207p. Contract AT(30-1)-2345. OTS.

The study deals with narrowing the range of parameters prior to preliminary design of the PM-1, a factory prepackaged, air-transportable, pressurized water nuclear power plant. The plant is to produce 1000 kw of net electrical power and 7×10^6 Btu/hr of space heat that is suitable for use with a central heating system. The data and conclusions resulting from the parametric study will provide the basis for the preliminary design of the PM-1 power plant. (W.D.M.)

10199 NAA-SR-Memo-66
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OMR STEAM CYCLE STUDY. G. S. Budney. July 5, 1957. 9p. OTS.

The efficiencies of various steam cycles adaptable for use with a 12,500-kw gross electrical OMR plant for various steam pressures are evaluated. The results of calculations are presented graphically and tabularly. (J.R.D.)

10200 NAA-SR-Memo-2056
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RE-EVALUATION OF OMRE HAZARDS WITH OM TERPHENYL AS THE MODERATOR-COOLANT. E. Clark, M. Raber, and R. Varnes. Sept. 19, 1957. 29p. OTS.

A summary of findings in a review of OMRE safety is presented. The evaluation is based on the use of OM terphenyl in the reactor, and changes in coolant due to loss of pressure were studied. It was concluded that for small leaks above core level, the operator has sufficient time to scram the reactor so that no boiling will occur within. Data are included on the relative properties of diphenyl and terphenyl. (J.R.D.)

10201 NAA-SR-Memo-3343
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PIQUA-OMR NEUTRON DETECTOR SHIELDING. D. S. Duncan. Nov. 21, 1958. 13p. OTS.

On the basis of the OMR radial shield design and detector specifications, the position and shield requirements for the neutron detectors were determined. An axially concentric lead–water shield is recommended. The required shield thicknesses between the cavity liner and the detector locations for the source, intermediate, and power range detectors are given. (W.L.H.)

10202 NAA-SR-Memo-3496
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
USE OF GRAPHITE AS EXTERNAL REINFORCEMENT FOR HIGH PRESSURE, HIGH TEMPERATURE STEAM TUBES. W. F. Anderson. Feb. 10, 1959. 5p. OTS.

A study was made of the possibility of using the graphite moderator logs as structural reinforcement for tubes within the log. (W.L.H.)

10203 NAA-SR-Memo-4347
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
TEMPERATURE DISTRIBUTION IN REGION OF FUEL SLUG END. D. J. McGoff. Sept. 8, 1959. 6p. OTS.

The temperature distribution in Al cladding, Al spacer, and fuel in the vicinity of the end of a fuel slug was determined. The effects of varying the length of the unfinned

surface were investigated. An organic coolant temperature of 600°F and an asymptotic cladding surface temperature of 750°F were assumed. (W.L.H.)

10204 NP-8329
Consumers Power Co., Jackson, Mich.
APPLICATION TO U.S. ATOMIC ENERGY COMMISSION FOR REACTOR CONSTRUCTION PERMIT AND OPERATING LICENSE. PART B. PRELIMINARY HAZARDS SUMMARY REPORT. [1959]. 257p.

A hazards summary is presented for the Big Rock Point Power Reactor being built by Consumer's Power Company in Charlevoix County of Michigan's lower peninsula. The main conceptual features of the plant are described with emphasis on the site and its environs along with a preliminary safety analysis of the project. Nominal electrical capacity is to be 50 Mw at a system pressure of 1050 psia. A research and development program to be carried out in the plant is described, which may permit 75 Mwe gross output at 1500 psia. (T.R.H.)

10205 ORNL-2888
Oak Ridge National Lab., Tenn.
GAS-COOLED REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1959. Feb. 17, 1960. 220p. Contract W-7405-eng-26. OTS.

A series of calculations was performed which indicates that a two-group, two-dimensional calculation based on a homogeneous representation of the EGCR core yields interpretable results for neutron flux and power distributions that are sufficiently close to the four-group heterogeneous core results to permit valid analyses of the effects of experimental loops on the core. The effects on radial power distribution in the EGCR core of various experimental fuel assemblies in the experimental loops were studied. Preliminary experimental results for a modified EGCR core rod lattice were obtained with the PCTR. The effect of stainless steel cladding on the graphite plugs and sleeves of the Title I dummy assemblies was studied. Preliminary calculations were made of the graphite damage that will occur in the EGCR as a result of moderation of fast neutrons. As part of an over-all study of the EGCR experimental loops, it was found that for the "worst" experimental fuel element being studied the circulating fission-product activity to be expected at equilibrium in a 1.5 Mw loop was 7.53×10^3 curies. Calculations were made to determine the effect of reflector thickness and composition on exposure of the pressure vessel to fast neutrons. A study was made of the absorption properties of the U^{233}, U^{235}, and Pu^{239} fission products as a function of the relative burnup of the fue and the degree of flux thermalization. Reactor Design Studies: A modification was made to the Title I EGCR fuel assembly which eliminates the need for making the final bottom weld with the cluster in the graphite sleeve. Fuel handling and coolant flow control provisions were studied to assess the effect of the lifting force of the gas stream on the fuel assemblies. Analysis of preliminary analog studies indicated that the rate of change of temperature of the fuel elements will not cause severe strains in the cladding due to the relative thermal expansion of the cladding and the UO_2. Studies are being made of deflections and stresses in the fuel element cladding under arbitrary temperature distributions. The first test of a metal-clad graphite body was completed. Studies of the coolant channel flow adjustments required for the EGCR led to a new concept of flow adjustment. The amount and nature of the contamination to be expected in the charge and service machines were studied. An analysis was made of the possibility of core levitation in the EGCR in case of single-ended or double-ended failures of the main exit coolant pipes. Heat Transfer and Fluid Flow: The study of heat transfer in the septafoil geometry was continued using an inlet plenum chamber screen arrangement designed to reduce the rotational component of the flow at the channel entrance. A series of tests using cotton threads to visualize the flow in the channel entrance indicated that a set of three coaxial screens in the inlet plenum region was most effective in reducing the rotational flow observed in earlier studies. Measurement of velocity profiles in the septafoil channel for a $\gamma = 2$ tube spacing was completed at five additional L/d_e levels ranging from the channel inlet to the outlet. Metallurgy: The continuous process for conversion to UO_2 was refined to the point where satisfactory reproducibility is being obtained. An apparatus for measuring the thermal conductivity of UO_2 was constructed. A series of compression tests of UO_2 at high temperature was completed. Equipment was designed and built for observing the mechanical behavior of encapsulated UO_2 by radiography. An apparatus was built for collecting and measuring the fission gases released from heated specimens of irradiated UO_2. Experiments on CO and CO_2-metal reactions were carried out at pressures as low as 10μ. An extensive series of tube-burst tests of type 304 stainless steel in various environments is being run. A thermal cycling test of a fuel capsule collapsed around UO_2 pellets was conducted that consisted of 75 cycles from 1000 to 1600°F at a rate of 100°F/min. Interim data were obtained on the effect of gaseous environments on the creep rate of type 304 stainless steel. The brittle fracture characteristics of various pressure vessel steels are being determined. Techniques for welding of dissimilar metals for cyclic service at high temperatures were studied. Experiments on the reaction of CO_2 with Be at 700°C indicated that the only reaction products are BeO and CO. Successful joining of Be to itself and to stainless steel by brazing was demonstrated. Testing of Components and Materials: Irradiation of UO_2 pellets in fission-gas-release experiments was extended to temperatures up to 3400°F. A series of irradiation experiments was initiated to evaluate graphite-clad fuel elements consisting of UC_2 in a graphite matrix. Instantaneous fission-gas-release experiments were continued. Comparisons of UO_2 specimens before and after irradiation in miniature capsules showed a correlation between initial bulk density and changes in structure and dimensions. A capsule containing two ThO_2-UO_2 cylinders encased in siliconized silicon carbide-coated graphite was tested in the closed-cycle-loop irradiation facility in the ORR. Studies were initiated to determine the effects of fast neutrons on the high-temperature strength of Be. Methods for removing irradiation-induced property changes in pressure vessel steels by periodic annealing were studied. Additional test results were obtained from out-of-pile tests designed to evaluate the corrosion behavior and structural stability of the EGCR fuel element assembly. Studies of the degassing behavior of various types of graphite were continued. A series of experiments was designed to determine the apparent interdiffusion coefficients of noble gases in reactor-grade graphites. Investigations of the chemistry of Cs showed that Cs metal is the most likely form of the Cs fission product in the EGCR. Studies of factors influencing the accuracy of thermocouples attached to metal surfaces in high-velocity cooling gas were continued. Methods of removing fission gases from the coolants of gas-cooled reactors are being studied. A study of the reliability of analyses of UO_2 fuel pellets was initiated. A system for the automatic continuous analysis of He from test loops was

put into service. Development of Test Loops and Components: Design criteria were established for the eight permanently installed experimental loops that are to be constructed as an integral part of the EGCR. The endurance test of a grease lubricated centrifugal compressor was continued with the compressor operating at 12,000 rpm in He at 590°F and 400 psig suction pressure. Studies were initiated to determine criteria for the compressors to be installed in the EGCR experimental loops. (For preceding period see ORNL-2835.) (W.D.M.)

10206 TID-7580
Division of Reactor Development, AEC.
PROCEEDINGS OF THE 1959 SYMPOSIUM ON LOW-TEMPERATURE NUCLEAR PROCESS HEAT, HELD AT ATOMIC ENERGY COMMISSION HEADQUARTERS BUILDING, GERMANTOWN, MARYLAND, OCTOBER 1, 1959. Jan. 1960. 76p. OTS.

The results of a survey on domestic process heat requirements in the United States are presented relative to distribution of energy consumption by various industries, fuel costs, and future demands. The technical and economical factors of low-temperature nuclear process heat reactors are evaluated. The economics and main features of the reactor systems PWR, BWR, and OMR are compared. The basic features and economics of the Experimental Low-temperature Process Heat Reactor are discussed. The economics and development of low-temperature nuclear process heat facilities are discussed. (C.J.G.)

10207 TID-8501(Pt. 2)(Suppl.)
Bechtel Corp., San Francisco and Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ORGANIC COOLED POWER REACTOR STUDY. 300 MW POWER PLANT CONCEPTUAL DESIGN, SUPPLEMENTARY STUDIES. June 1959. 276p. Contract AT(11-1)-708. OTS.

Available effort was devoted in part to further investigations of the reference reactor system including an evaluation of fuel materials and design, control materials, further definition of core power distribution and power flattening measures, in-core instrumentation, safety and stability characteristics including the effects of nucleate boiling heat transfer under reactor transient conditions, and reconsideration of the reactor refueling procedures. The process and auxiliary reactor systems were studied further with a view to simplification. Parametric studies of the primary loop and steam cycle were performed. A brief study of a modified reference core design which did not permit nucleate boiling in the core was carried out, and an estimate of incremental costs resulting from that design approach was prepared. (W.D.M.)

10208 TID-8516
Atomic Energy Commission, Washington, D. C.
CIVILIAN POWER REACTOR PROGRAM. PART I. SUMMARY OF TECHNICAL AND ECONOMIC STATUS AS OF 1959. 1960. 142p. GPO.

The current technical and economic status for each reactor concept in the Civilian Power Reactor Program is summarized. The individual technical status reports which present detailed information will be published by AEC as TID-8518. Included in this summary are: power costs for various reactor types versus coal-fired plants; construction schedule for heavy-water natural-U reactors; and annual program costs. (T.R.H.)

10209 WCAP-4009
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC. CVTR PROJECT. Monthly Progress Report [for] January 1960. 27p. OTS.

Progress on the development of the Parr Shoals Power Reactor (CVTR) is briefly summarized in the areas of nuclear design, pressure tube assembly development and analysis, fuel development, irradiation experiments, materials development and fabrication, chemical surveillance of materials and systems, component development, plant system development, instrumentation and control, and critical experiment. (For preceding period see WCAP-4002.) (W.D.M.)

10210 YAEC-74
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
PRESSURE DROP, FLOW DISTRIBUTION AND MIXING STUDIES FOR A MODEL HETEROGENEOUS REACTOR VESSEL. R. T. Berringer and A. A. Bishop. Dec. 1959. 61p. For The Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

A series of hydrodynamic tests was conducted on a 1:12 scale model of the Yankee reactor vessel and core with four, three, and two loop operation. There was no depression of flow in the center of the core due to the control rod shrouds or shroud support plate. With four loops operating, flow distribution tests at the core inlet indicated that for all operating conditions the highest velocities occurred in the center region of the core and were a maximum of 18% higher than the average velocities. The lowest velocities were in the region near the core baffle and were a minimum of 18% lower than the average velocities. The effective flow starvation at the points of high flux were less than the 7% design value. Mixing studies indicated that no inlet position of the core received more than 55% of its total flow from one loop. The flow distribution did not change appreciably for four, three, or two loop operation. The measured pressure drop across the vessel correlated within 6% of the predicted value. (auth)

10211 YAEC-125
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
WCAP-4 IN-PILE TEST LOOP HAZARDS ANALYSIS MANUAL. C. D. Dishman, R. P. Goldstein, G. H. Eng, A. Bournia, R. Berringer, W. Eich, A. Krieg, and J. J. Lombardo. June 1959. 119p. For the Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

From the WCAP-4 in-pile test loop information will be obtained as to how the Yankee fuel pins will withstand the high heat flux of 450,000 Btu/hr-ft^2, pressure of 2000 psia, and temperature of 500 to 600°F. Possible hazards associated with the operation of WCAP-4 loop experiment in the MTR are presented and each hazard and action taken to minimize or eliminate the hazard are analyzed. (W.D.M.)

10212 YAEC-155
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
DESIGN AND TEST ANALYSIS OF THE MAGNETIC JACKING POSITIVE LATCH CONTROL ROD DRIVE MECHANISM. L. J. Balog, A. A. Bishop, and T. F. Widmer. July 1959. 125p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Sub-contract No. 1. OTS.

Testing of the Latch Type Magnetic Jack Control Rod Drive Mechanism was undertaken to determine its feasibility for application in the Yankee Atomic Electric pressurized water reactor. The rod drive mechanism, which will be weld mounted to the top of the reactor, is a hermetically sealed unit. The inherent advantages of this feature include

(1) uniform pressure over the length of the control rod allowing for more reliable scramming and (2) the absence of high-pressure shaft seals. The latch-type mechanism is capable of functioning under greater loads since support of the weight depends on magnetically actuated latches engaging a grooved drive shaft rather than a frictional force between metal surfaces in contact. Design calculations describe this facet of the mechanism along with other pertinent mechanical and electrical features. Another advantage of the latch type mechanism which lends itself to more accurate control is the parity of distance traveled up to distance traveled down for a given number of steps. In the case of a friction grip mechanism, downward travel could exceed upward travel for the same number of steps in each direction due to slippage between metal surfaces. Tests performed on the latch type mechanism varied in nature from the determination of load carrying capacity to an evaluation of the operational reliability when an excessive amount of crud was present in the mechanism environment. Heat transfer tests were conducted on a positive grip type control-rod drive mechanism to determine the air cooling required to prevent exceeding the maximum allowable coil temperature of 450° F. Based on the tests, an air flow rate of 9650 CFM was recommended for the 24 control rod drive mechanisms. (auth)

10213 T-55(RAND)

RAND Corp., Santa Monica, Calif.

THE RUSSIAN ATOMIC AIRPLANE OF THE FUTURE. F. J. Krieger. Jan. 26, 1956. Includes translation of article by G. I. Pokrovskii (Pokrovsky) from Tekh.-Molodezhi, Aug. 1955. 7p.

An idea for design of a nuclear-powered airplane based on fission in uranium dust in a graphite moderated area is presented. (J.R.D.)

10214

NUCLEAR REACTORS FOR SHIP PROPULSION. REPORT ON THE SECOND HAMBURG REACTOR CONFERENCE. W. Kliefoth. Atomkernenergie 5, 66-73(1960) Feb. (In German)

A summary is presented of the reports given at the conference on nuclear propulsion for ships held in Hamburg, Nov. 26-28, 1959. The topics discussed included the development of nuclear propulsion units in Germany, the OMR (the first German ship reactor), testing on the research ship "Esso Bolivar," organic-moderated reactors, boiling water reactors, gas-cooled reactors, gas-cooled reactors with sealed gas turbines, and a comparison of various maritime reactor types. (J.S.R.)

10215

SOME THEORETICAL ASPECTS OF THE KINETICS OF THE CIRCULATING FUEL REACTORS. C. Lo Surdo (Societa Richerche Impianti Nucleari, Milan). Energia nucleare (Milan) 7, 88-94(1960) Feb. (In Italian)

Some general considerations on reactor kinetics are exposed with special reference to the case of circulating fuel and some simple and known results of the theory are emphasized. (auth)

10216

EARTHQUAKE RESISTANT DESIGN OF CALDER HALL IMPROVED TYPE POWER REACTOR TO BE ERECTED IN TOKAI MURA, (II). ASEISMIC SCHEMES OF THE REACTOR STRUCTURE. K. Mutó (Univ. of Tokyo). J. Atomic Energy Soc. Japan 2, 24-33(1960). (In Japanese)

The aseismic design and some construction features of the Tokai Mura Reactor are discussed. Safety devices of the reactor are described. (C.J.G.)

10217

ADVANCED WATER REACTOR SYSTEMS. PART II. DESIGN STUDIES OF PLANTS FOR ECONOMIC POWER. Nuclear Energy 14, 62-4(1960) Feb.

The design characteristics of an advanced water reactor system are presented for power plants. The proposed design is for a 330 Mw(e) closed cycle plant. The reactor vessel is designed to operate at 650°F. Steam conditions at the turbine throttle are to be 650 psia, dry and saturated. The expected start-up date is planned for early 1965. (B.O.G.)

10218

THE DRAGON REACTOR, DEVELOPMENT AND DESIGN OF THE HTGC. G. E. Lockett and R. A. U. Huddle (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 5, No. 46, 112-17(1960) Feb.

The development and design of the High Temperature Gas Cooled Reactor Experiment are discussed. Fuel element design is discussed, and descriptions of the coolant circuit, reactor containment shell, and reactor layout are given. The charge-discharge procedure is discussed. (C.J.G.)

10219

SHIELDING DESIGN, THEORY AND PRACTICE. K. T. Spinney (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 5, No. 46, 134-7(1960) Feb.

Methods of calculating neutron and gamma penetration into matter and radiation streaming in ducts and voids are reviewed relative to shielding design techniques. (C.J.G.)

10220

REACTOR INCIDENTS AT SACLAY. P. Balligand (Centre d'Études Nucléaires, Saclay, France). Nucleonics 18, No. 3, 82-5(1960) Mar.

Incidents at EL-2 and EL-3 during the period January 1, 1957, to July 1, 1959, are described. These incidents, caused primarily by fuel cladding rupture, are considered both typical and instructive. Special handling equipment and techniques resulting are treated. (B.O.G.)

10221

SIOUX FALLS SUPERHEAT DESIGN TAKES FINAL FORM. Nucleonics 18, No. 3, 108; 110; 113(1960) Mar.

A study is presented of the final design of the nuclear superheater to be incorporated in the Sioux Falls reactor by Allis Chalmers. The characteristics of this design are given along with the over-all data of the reactor proper. The reactor capacity is 62-Mw(e) net output with maximum temperature and pressure at 825°F and 600 psi, respectively. The superheater section is expected to attain a maximum fuel surface temperature of 1330°F. (B.O.G.)

10222

NATURAL AND ENRICHED URANIUM IN NUCLEAR POWER PLANTS. Wilhelm Rotter. VDI Zeitschrift 101, 1697-1701(1959) Dec. 11. (In German)

A comparison of the capital outlay per kw of installed capacity of nuclear power plants which use natural or enriched uranium fuel is presented. The economics of using natural uranium vs. enriched uranium are discussed relative to separation processes for enriched uranium. (C.J.G.)

10223

SOME EXPERIENCES OF CALDER HALL POWER REACTORS. K. A. Swinburn (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). VDI Zeitschrift 101, 1702-6(1959) Dec. 11. (In German)

The performance and operational problems encountered with the Calder Hall power reactors are discussed. A discussion is presented of the experiments which were made

to determine reactor response to changes in operating conditions after the temperature coefficient of the moderator became positive through plutonium formation. The accumulation of stored energy in the graphite of the reactors is discussed relative to approximate time before annealing. Radiation levels around the reactor are discussed. (C.J.G.)

10224

PRESSURE SUPPRESSION CONTAINMENT FOR NUCLEAR POWER PLANTS. ASME Paper 58-A-215. C. C. Whelchel (Pacific Gas and Electric Co., San Francisco) and C. H. Robbins (General Electric Co., San Jose, Calif.). New York, The American Society of Mechanical Engineers, 1959. 10p. $0.80.

A description of a pressure-suppression system for reactor containment is given. The arrangement consists of the reactor core being situated in a dry well containing air at atmospheric pressure. The dry well vents into a water pool enclosed by an air-filled vapor-tight container. The results of tests on effective condensation and strapping of fission product gases in the pool are discussed. Design considerations in pressure suppression systems are discussed. (C.J.G.)

10225

NUCLEAR POWER PLANT. E. Openshaw Taylor. London, George Newnes Limited, 1959. 188p.

The principles underlying nuclear power generation are considered relative to the energy requirements and resources of the world, nuclear and reactor physics, types of reactors, reactor engineering, reactor control and instrumentation, and economics of nuclear power stations. (C.J.G.)

10226

EVALUATION OF MAJOR LOSS-OF-COOLANT TYPE ACCIDENTS AND DESIGN CRITERIA FOR THE CONTAINMENT OF WATER-COOLED OR WATER-MODERATED REACTORS. E. Jantsch (A. G. Brown, Boveri and Cie, Baden, Switzerland). p.141-64 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Water-cooled or water-moderated reactors in the U. S. are contained in a pressure-tight steel sphere or cylinder. Design calculations for these vessels usually infer a total loss-of-coolant accident as the maximum for obtaining design pressure. Detailed hazard evaluations include a prediction of conservative pressure variation with time. An attempt is made in this paper to standardize the mathematical methods and parameters involved and to compare results for different types of containment. It is shown that safe vessels which do not depend on a pressure suppression system can be designed. No consideration is given to shock waves or missile formation. (T.R.H.)

10227

THE INTRINSIC CONTROL MECHANISM OF HETEROGENEOUS WATER-MODERATED THERMAL REACTORS. Aldo Ascari (SORIN, Milan). p.329-40 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

Published data from BORAX and SPERT experiments are used in calculations which point out the difficulties in such experiments, the applicability of the results, and the difficulty of formulating an adequate theory. (T.R.H.)

10228

THE BRADWELL POWER STATION; WIGNER ENERGY AND MODERATOR DESIGN. F. Carr (Nuclear Power Plant Co. Ltd., [London]) and C. Marchetti (AGIP Nucleare, Italy). p.341-52 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

The problem of stored-energy release in graphite-moderated reactors is discussed. The necessity for reaching high enough temperatures to release stored energy is pointed out, and two methods for accomplishing this are given: higher coolant temperature or insulation of coolant channel from moderator. The latter method as used in the Bradwell Power Station reactors is described. At Bradwell, graphite sleeves are inserted in oversize fuel channels to form a thermal barrier which allows the moderator brick to achieve the required temperatures. The sleeves are periodically replaced. A high-temperature anneal (~600°C) would be expensive since fuel elements would have to be removed and heat supplied. The method under development at AGIP Nucleare, Milan, is discussed which involves annealing one channel at a time. (T.R.H.)

10229

SAFETY FEATURES OF A BOILING WATER NUCLEAR POWER PLANT. E. R. Owen and G. Sege (General Electric Co., San Jose, Calif.). p.353-68 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

A review is presented of the safety of boiling water nuclear power plants with specialized consideration given to the large dual-cycle plant. The dual-cycle type plant is described and safety design criteria and shielding design criteria pointed out. The necessity for a heat sink in the event of load rejections is described, and automatic reactor protection features are discussed. Maximum credible accidents are considered to indicate the inherent safety features. (T.R.H.)

10230

FUNCTIONAL CHARACTERISTICS OF BOILING-WATER REACTORS WITH RESPECT TO SAFETY. Giuseppe Quilico. p.369-80 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

The inherent safety features of boiling-water reactors are pointed out and discussed. (T.R.H.)

10231

THE INCIDENCE OF THE MOL SITE ON THE SAFETY OF BR-2. H. Dopchie (Centre d'Etude de l'Energie Nucleaire, Brussels). p.381-410 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

The site of Mol was chosen before the erection of the BR-2 reactor was decided. Its location in a relatively populated area has caused serious precautions in the conception and achievement of the pressure-tight building and of certain safety apparatus. The evaluated consequences of the maximum credible accident on outside population are briefly related. (auth)

10232

SAFETY ASPECTS OF THE BELGIAN BR-3 REACTOR. P. Dozinel (Bureau d'Etudes Nucléaires, [Brussels]) and J. Storrer (Societe Belge pour l'Industrie Nucleaire, [Brussels]). p.467-575 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico,

Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

A short description of the plant and of the site is first given. The waste and the ventilation systems are discussed as part of the health engineering. The treatment and the ultimate disposal of the solid and liquid wastes, however, are not included. The safety of BR-3 is analyzed under four main headings: (a) the general personnel protection, which includes the control of the access to the plant and its various subdivisions, the shielding and the monitoring system; (b) the primary plant control, which studies its response to changes in load demand, without and with external control, and analyzes the control scheme; (c) the accidents analysis, which evaluates the probability and importance of various accidents and studies for each type of accident the features which have been designed into the plant to limit the damage and hazards if the accident occurred. The accidents which are discussed are the loss-of-electrical-supply accident, the reactivity accidents, the loss-of-coolant-flow accident, the loss-of-coolant accident and the worst credible accident; (d) the hazards analysis of the worst credible accident. (auth)

10233

NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). British Patent 826,929. Jan. 27, 1960.

A graphite-moderated water-cooled reactor design is described. (T.R.H.)

10234

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Dennis William Ginns and Harold Howard Gott (to United Kingdom Atomic Energy Authority). British Patent 826,930. Jan. 27, 1960.

A finned fuel element design is offered. (T.R.H.)

10235

IMPROVEMENTS IN OR RELATING TO HEAT TRANSFER SYSTEMS. George Clifford James Dalton and George Edward Lockett (to United Kingdom Atomic Energy Authority). British Patent 826,931. Jan. 27, 1960.

A fast reactor cooling system is described. Coolant tubes pass through a container of the metal fuel which is liquid during reactor operation. The liquid-metal coolant flowing through the shell-and-tube core is satisfactory mechanically and provides a heat transfer comparable with a multiple flat-plate structure. (T.R.H.)

10236

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR UNITS. Jack Britt (to Rolls-Royce, Ltd.). British Patent 828,055. Feb. 10, 1960.

A reactor charge-discharge unit is described which is to be used in conjunction with the reactor and fuel element described in British patent No. 828,054. The core and fuel element manipulator are in a frusto-conical or pyramidal casing with the manipulator at the small end. The manipulator and fuel element and core are designed to operate with each other for ease of loading and unloading. (T.R.H.)

10237

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. Leslie Mark Wyatt and Richard Phillip Kinsey (to United Kingdom Atomic Energy Authority). British Patent 829,139. Feb. 24, 1960.

A fuel element design to relieve fission gas pressure is described. A zirconium can with domed ends contains three loosely fitted pieces of U surrounded by Na. These pieces of U are hollowed to contain an evacuated Zr tube-capsule which is of thinner material than the can so that it preferentially yields to pressures within the fuel element. (T.R.H.)

Research Reactors

10238 IDO-16566

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ETR NUCLEAR INSTRUMENTATION. Final Report. D. C. Hanson. Feb. 3, 1960. 29p. Contract AT(10-1)-205. OTS.

Problems encountered in the early stages of operation of electrically compensated ion chambers installed in the bottom head and horizontal neutron chamber thimbles in the Engineering Test Reactor are discussed. The performances of a neutron level monitoring system which initiates electronic scrams, servo-ion chambers, and a boron thermopile system are discussed. (C.J.G.)

10239 WCAP-1316(and Add. 1)

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

SAFETY REPORT FOR THE CRITICAL REACTOR EXPERIMENT FACILITY. D. F. Hanlen, D. Hunter, and P. W. Davison. Oct. 1, 1959. 130p. Addendum 1: REVISIONS. D. F. Hanlen, D. Hunter, P. W. Davison, and H. W. Graves, Jr. Jan. 15, 1960. 50p. OTS.

Administrative rules and operating restrictions governing the safety aspects of the Critical Reactor Experiment Facility are given. Descriptions of the site, reactor facility building, adjacent building facilities, reactor control systems, and reactor operations are given. An accident and hazards analysis of the reactor is included and the methods of the analysis are described. (C.J.G.)

10240 CEA-tr-A-663

LE RÉACTEUR DE RECHERCHES DE FRANCFORT-SUR-MAIN. (The Frankfurt-am-Main Research Reactor). E. Schopper. Translated into French from Atomwirtschaft 2, 217-24(1957). 34p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 12253.

10241

SAFETY PRINCIPLES FOR LOW POWER RESEARCH REACTORS. B. E. Eltham and E. P. Hicks (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). Nuclear Eng. 5, 96-8(1960) Mar.

Considerations are presented of some of the safety criteria which should guide the design and location of low-power pool- and tank-type reactors for use by universities or private laboratories. Particular attention is directed to excess reactivity in the system, sufficient reactor cooling, and containment. (B.O.G.)

10242

RESEARCH REACTORS: A SURVEY OF CURRENT DESIGNS, PART 1. Nuclear Eng. 5, 99-104(1960) Mar.

A survey is presented of the characteristics of current designs for research reactors. These reactor designs include: (1) Babcock open pool reactor, 1 to 5 Mw; (2) Indatom's pool reactors, Amelie and Beatrice; (3) Atomics International solution-type; (4) General Atomic TRIGAs; (5) Foster-Wheeler tank-type; (6) the Argonaut family, built by Hawker Siddeley, AMF Atomics, and American Standard; (7) Aerojet-General Nucleonics tank- and pool-types; (8) NDA 10-kw D_2O-type; and (9) Allis-Chalmers high-flux reactors. (B.O.G.)

10243

RESEARCH REACTORS: THE UNIVERSITIES' APPROACH. W. B. Hall (Univ. of Manchester, Eng.); J. P. F. Sellschop (Univ. of the Witwatersrand, Johannesburg); W. Murgatroyd (Univ. of London); H. Maier Leibnitz (Technische Hoch-

schule, Munich); F. Rossillon (Atomic Energy Centre, Grenoble, France); and M. Soutif (Univ. [of Grenoble, France]). Nuclear Eng. 5, 105-10(1960) Mar.

A series of articles is presented which includes the criteria governing the choice of reactor types for a given university and the facilities of the reactor under investigation. An analysis is given of the requirements of British universities, in which the predominant necessity is the investigation of problems in nuclear engineering. Experiences with 1-Mw swimming pool reactors are discussed. The flux in these reactors, about 10^{13} n/cm^2 sec in the center, is necessary for most experiments and is small enough to avoid excessive difficulties with cooling and handling equipment near the reactor. The criteria governing the choice of a reactor for training purposes in the Union of South Africa are discussed. (B.O.G.)

10244

FAST-NEUTRON AND GAMMA SPECTRA FOR BSR. R. L. French and J. B. Eggen (Convair, Fort Worth, Tex.). Nucleonics 18, No. 3, 117-18; 120(1960) Mar.

Shielding calculations for "back-of-the-envelope" were made from gamma and fast-neutron dose rate and thermal-neutron flux studies at the centerline of the Bulk Shielding Reactor. Complete calculated values for gamma and fast-neutron spectra are presented which should increase the usefulness of BSR centerline data. The validity of these calculations are shown by their agreement with measured data. The gamma and fast-neutron spectra are especially useful in determining the penetration through or heating of materials placed in water near a BSR-type reactor. For gamma rays, the use of the continuous energy spectrum rather than of an average or "effective" gamma energy gives results of considerably greater accuracy. (B.O.G.)

WASTE DISPOSAL AND PROCESSING

10245 AECL-450

Atomic Energy of Canada Ltd., Chalk River, Ont. THE DISPOSAL OF RADIOACTIVE WASTES. Ivan L. Ophel. [1957]. 5p.

Reprinted from Proceedings of the Second Industrial Waste Conference, Guelph, Ontario, June 19-22, 1955, p.83-6, 1957.

The activity and types of radioactive waste and the effects of disposal to streams and rivers are discussed. (C.J.G.)

10246 NSEC-7

Nuclear Science and Engineering Corp., Pittsburgh. RETENTION EFFICIENCIES OF CHARCOAL TRAPS FOR FISSION GASES. Technical Report. R. C. Koch and G. L. Grandy. Aug. 23, 1957. 65p. OTS.

The efficiency of charcoal traps for tracer quantities of fission product gases in the presence of macro quantities of a nonisotopic purge or carrier gas was investigated. The effects of charcoal particle size trap temperature and nitrogen carrier gas flow rate were observed with the emphasis on the behavior of xenon and krypton. A limited number of experiments using iodine as tracer was also performed. Experimental techniques are described and data are included. (J.R.D.)

10247

THE CONTROL OF RADIOACTIVE WASTES. Presented to Parliament by the Minister of Housing and Local Government and Minister for Welsh Affairs and the Secretary of State for Scotland, by Command of Her Majesty, November 1959. London, Her Majesty's Stationery Office, 1959. 46p. $0.35.

A survey was made of radioactive wastes now produced and likely to be produced in the development of nuclear power, nuclear research, therapeutic use of radionuclides, and in industrial uses of radioactive materials. It was found that the wastes could be disposed of by conventional methods provided that appropriate precautions be taken to reduce the harmful aspect. Permission was granted to the United Kingdom Atomic Energy Authority for storing or dumping at sea wastes which cannot be disposed of by conventional methods. These include concentrated fission product liquid waste from chemical processing of reactor fuel elements, spent closed sources, and solid wastes from luminizing. It was concluded that more appropriate facilities should be established for the disposal of wastes of this type from all producers and a need exists for the establishment of a central body sufficiently competent to judge the issues involved and in close touch with advisory and other bodies with responsibilities in this field. It is considered that comparatively few of the local bodies at present exercising powers in relation to waste disposal have the staff qualified to advise on matters concerning radioactivity. In view of the national shortage of trained personnel, it is proposed that a central governmental body be organized for the control of radioactive wastes. Provisions were presented for legislation in the control of wastes, but no attempt was made to draft a bill designed to put these recommendations into effect. (B.O.G.)

10248

MEDIUM AND LOW LEVEL WASTE DISPOSAL ON ALLUVIAL AND RECENT DEPOSITS. Yoan Harpaz (TAHAL, Water Planning for Israel Ltd., Tel-Aviv, Israel). p.27-32 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume I." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Earth materials underlying a plant site, their geology, texture, and groundwater hydrology have an influence on the complex evaluations called for in locating nuclear plants. Recent deposits and alluvial soils are scattered in abundance over many areas of land. Their granular constituents (gravels, sands) are a good hydraulic medium which can be treated mathematically. The silt and clay particles in such soils have the highest absorption and exchange capacity. Thus, alluvial soils may provide the plant planner with an effective and practical collector for low and medium radioactive waste solutions. The rate of disposal and the degree of permissible radioactivity will depend also on other hydrological factors, as well as on the type of installation employed. (auth)

10249

THE HANDLING AND DISPOSAL OF RADIOACTIVE SOLID WASTES. R. H. Burns (United Kingdom Atomic Energy Authority, Harwell, Berks, England.) p.265-86 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

Handling and disposal of solid radioactive wastes in Great Britain are discussed. The types of waste are pointed out and storage, ground disposal, burial, mine disposal, sea dumping, and volume reduction are considered. The legal position in Great Britain is summarized. (T.R.H.)

10250

TREATMENT AND FINAL CONDITIONING OF SOLID RADIOACTIVE WASTES. Jacques Cerré (Centre d'Etudes Nucléatres, Saclay, France). p.287-300 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

A proposed waste treatment plant for CEA, Saclay, is described which will reduce the volume of wastes with total confinement of contamination and protection against radiation. After describing the types of waste to be handled and the problems involved and the solutions adopted, the building and its equipment are described in detail. (T.R.H.)

10251

TREATMENT OF RADIOACTIVE EFFLUENTS BY A COMBINED CHEMICAL AND ION EXCHANGE PROCESS STORAGE OF THE CONCENTRATED SLUDGES. P. Dejonghe and L. Baetslé (Centre d'Etude de l'Energie Nucleaire, [Brussels]). p.325-42 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In English)

The general conclusions from studies of cheap chemical and ion-exchange methods applicable for concentration of radioactive effluents for storage are given. It was found that in areas critical because of population and water supply the effluents can be treated cheaply and safely by a combined chemical-ion exchanger process. The concentrates and other materials from this process can be transformed into a solid transportable form. For final storage, clay formations seem safe. (T.R.H.)

10252

EFFLUENT PROBLEM OF A PLUTONIUM PRODUCTION CENTER. Robert Galley and Jacques Cantel (Commissariat à l'Énergie Atomique, Paris). p.343-84 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In French)

Waste disposal at a Pu production site such as Marcoule, France, is discussed. The general geographical features of the Marcoule region and the Rhone river into which the waste is discharged are described, and the source of the radioactive effluents and the treatment process are described generally. Then details of the treatment plant and process are given including the storage tanks, precipitation installation, filtration section, residue conditioning, residue removal, and disposal. Factors involved in design and operation of such a plant are given along with recommendations. (T.R.H.)

10253

TREATMENT OF RADIOACTIVE WASTE PRODUCED BY A NAVAL NUCLEAR POWER PLANT. Luigi Pizzi (FIAT, Sezione Energia Nucleare, Turin). p.431-48 of "VI Rassegna Internazionale Elettronica e Nucleare. Atti Del Congresso Scientifico, Giugno 1959. Sezione Nucleare. Volume II." Rome, Comitato Nazionale Ricerche Nucleari, [1959]. (In Italian)

An evaluation of the coolant radioactivity and its effects on the purification system is made in connection with a pressurized-water reactor for a 70,000 ton naval vessel. The amount and activity of fission products and corrosion products in the primary coolant and purification system are presented graphically. These values are then considered with regard to shielding, ventilation, and accessibility of the reactor containment vessel. The collection and treatment of the radioactive wastes are briefly discussed. (T.R.H.)